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MONTHLY REPORT

ON THE NUCLEAR FUEL MARKET

NUEXCO

HEADQUARTERS

Three Park Central
1515 Arapahoe Street
Suite 1045
Denver, Colorado 80202
Telephone: (303) 623-7317
Telecopy: (303) 825-4821

Managing Director
Oren L. Benton

NORTHEAST UNITED STATES

100 Prospect Street
Century Plaza South
Stamford, Connecticut 06901
Telephone: (203) 323-1999
Telecopy: (203) 325-1483
Telex: 4750124 (NUEXCO C)

Managing Broker
Earl E. Hoellen, Jr.

SOUTHEAST UNITED STATES

Suite 905
Ten Piedmont Center
Atlanta, Georgia 30305
Telephone: (404) 262-7375
Telecopy: (404) 233-6210
Telex: 4611142 (NUEX ATL)

Managing Broker
M. Jerry Reaves

WESTERN UNITED STATES

Building 3, Suite 290
3000 Sand Hill Road
Menlo Park, California 94025
Telephone: (415) 854-1510
Telecopy: (415) 854-2115
Telex: 470674 (NUEXCO UI)

Managing Broker
George White, Jr.

EUROPE

13 chemin du Levant
01210 Ferney-Voltaire
France
Telephone: (33-50) 428035
Telecopy: (33-50) 428526
Telex: 385288 (NUEXCO F)

Managing Broker
James E. Vaughan

REGIONAL MANAGING BROKERS

AFRICA
James E. Vaughan

AUSTRALIA
George White, Jr.

CANADA
Wayne D. Fowler

EUROPE
James E. Vaughan

FAR EAST
Christian C. Guitton

(See inside back cover for list of Representatives and Consultants)

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MONTHLY REPORT ON THE NUCLEAR FUEL MARKET
November 1985 No. 207

GEORGE WHITE, JR., *EDITOR* CLARK M. BEYER, *ASSOCIATE EDITOR*

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NATURAL URANIUM AND SECONDARY MARKET CONVERSION

(All data as of October 31, 1985)

The **Exchange Value** is **$16.50** per pound U_3O_8, up $0.50 since last month. **Active supply** of natural uranium (U_3O_8 and UF_6) for spot or near-term delivery totals **3,210,000** pounds equivalent U_3O_8 as concentrates or UF_6, up 1,115,000 pounds since last month. The corresponding figure for **active demand** is **895,000** pounds, down 205,000 pounds. The spot and near-term **supply-demand ratio** rose to **3.6:1.**

The *Current Market Data* section of this Report lists five natural uranium sales transactions, involving a total of approximately 1,400,000 pounds U_3O_8. All of the transactions reported this month involved deliveries in the near term, and three met the criteria for inclusion in the current Transaction Value calculation.

The **Transaction Value** is **$15.75** per pound U_3O_8, up $0.65 since last month. Because June transactions, most of which were concluded at prices below $15.00, were removed from the calculation, there was a considerable rise in the Transaction Value.

The **UF_6 Value** is **$46.00** per kilogram U in UF_6, up $1.50 since last month.

The **Conversion Value** is **$1.60** per pound U in UF_6, unchanged since last month. No active supply or demand of secondary market conversion services for delivery within three years is reported. In addition, no secondary market conversion transactions are reported, reflecting the reduced availability of conversion services on the secondary market. Moreover, discretionary buyers are not compelled to purchase unless opportunities arise that can offer substantial discounts from primary market conversion prices.

The **Loan Use Charge Rate** is unchanged at **5 percent** per annum, as both lenders and borrowers continue to express their interest in doing business at that level.

* * *

The Exchange Value and UF_6 Value rose slightly this month in the wake of higher transaction prices and overall market firming. Much of the current demand consists of longer-term opportunities, and fewer opportunities for immediate delivery are occurring as the end of the year approaches. Buyers generally appeared more willing to consider price levels that were viewed as too high last month. Nevertheless, a wide range of transaction prices is in effect; smaller quantities on the order of 100,000 pounds are available at slightly below $16.50, but larger quantities closer to one million pounds cannot be obtained at that level.

The UF_6 Value remains slightly less than the algebraic sum of the Exchange and Conversion Values. The presence of a few sellers that are willing to discount UF_6 in order to sell it on short notice continues to restrain UF_6 prices from reaching parity.

The weakening of the US dollar against other currencies continued, causing the effective price of dollar-denominated uranium to rise in those currencies. The US dollar's decline again served to discourage sellers of spot or near-term material, while helping buyers intent on purchasing at dollar prices.

While a general sense persists that spot prices will continue to move higher in the near term, buyers' resistance is such that the price rise for near-term delivery has been moderate, largely reflecting the discretionary nature of near-term demand. For their part, most sellers, in light of DOE's non-viability findings and the federal court decision invalidating the USEC, are now confident of higher prices and appear content to wait.

Most market participants readily agree (and some recently announced contracts appear to confirm) that prices expressed in constant dollars for longer-term delivery are considerably above current spot market levels. However, there is a wide divergence of opinion regarding the timing and inevitability of a price convergence. Those arguing that spot prices must move sharply higher in the near term assert the following:

1. Most of the distress inventory has been sold, removing this source of downward price pressure.
2. The Secretary of Energy's finding that the US uranium industry is not viable indicates that a reimposition of some form of limitation on imports of non-US origin material is likely. Such a limitation would lead to higher prices as US utilities become forced to buy uranium from higher-cost US producers.
3. Notwithstanding any new import limitation, utility assumptions about the availability of uncommitted, low-cost, non-US supply are overly optimistic, and it will soon become apparent that buyers, particularly in the USA, will be seeking more uranium than is available from non-US sellers.

Opposing points of view take issue with such reasoning by arguing that:

1. Past predictions of the end of inventory selling have been premature. Total inventory continues to grow, and more can be made available to the market through borrowing and selling or related schemes.
2. Notwithstanding the non-viability finding, reimposition of an import limitation is unlikely for both economic and political reasons. Industry viability was a concern 30 years ago when resource availability was less certain. There is no longer such concern.

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3. Arguments about the national security issue are specious. A uranium embargo would be particularly offensive to Canada, the USA's largest trading partner, and in view of the Reagan administration's refusal to protect artificially the steel, automobile, copper, shoe, and other industries, difficulties in the uranium industry are unlikely to trigger protectionist legislation. The removal of Canada's upgrading requirement or Australia's floor price could also undercut demands to protect the US industry.

Current near-term buying is based more on economic considerations than on security of supply. The availability of low-cost resources is well-known, so a procurement panic is unlikely to develop.

The argument that prices will increase at a moderate rate rests on the long-term economic reality of large uranium discoveries having high ore grades and low production costs. This argument discounts the implication that in the long term it is possible to impose prices through legal, procedural, or other non-economic means. Thus, while the USEC invalidation ruling and non-viability finding have caused a good deal of speculation, these two events have not precipitated any dramatic market reaction to date.

* * *

As anticipated, the Justice Department, on behalf of DOE and the three US producer plaintiffs, filed a new round of cross-motions for summary judgment in the Denver lawsuit. In addition, the Uranium Producers of America filed an *amicus curiae* brief on behalf of the plaintiffs. The plaintiffs' principal thrust is aimed at Count I of the complaint, and argues that since the industry has been found non-viable, DOE must *immediately* cease all enrichment of non-US origin uranium destined for use in US reactors, pending development of new criteria governing the use of non-US material.

If the court were to rule in favor of the plaintiffs on this issue, the results could be dramatic. Even if stayed or appealed, such a ruling would create great uncertainty and would likely initiate a period of intense market activity. Any natural inclination to assume a sudden and sharp rise in spot-market prices for US-origin uranium must be balanced against other market factors. Substantial quantities of US-origin material are held by non-US entities and would be available for nationality swaps. US inventories are at record-high levels. A more sophisticated utility market sector is unlikely to precipitate the panic-buying behavior that characterized the aftermath of Westinghouse's 1975 default.

ENRICHED URANIUM AND SWUS

The Nuexco **SWU Values** as of October 31, 1985 are:

1. For **DOE origin,** a tails assay of 0.30 weight-percent U_{235}, for delivery by the end of FY86, and certifiable as excess, **$83** per SWU, down $2.

For **other** SWUs (includes DOE origin SWUs not certifiable as excess and non-DOE origin SWUs), for delivery by the end of calendar year 1986, **$83** per SWU, up $5.

No secondary market SWU transactions are reported this month, as the markets for DOE-certifiable SWU and non-DOE or non-certifiable SWU ostensibly converged into one market. The identical SWU values this month indicate the demise of the two-tiered SWU market which arose one year ago. Two main factors are responsible:

1. Virtually all potential buyers restricted by DOE to purchasing certifiable SWU have covered their requirements. One opportunity for a moderate quantity remains in the market. Sellers holding certifiable SWU are actively pursuing this last opportunity, applying downward pressure on the DOE-certifiable SWU Value until a transaction occurs. Henceforth, sellers of certifiable SWU will be forced to sell to buyers that are not restricted to the DOE market. Already, at least one large seller has decided to market its SWU in competition with the non-DOE SWU sellers, effectively ending the two-tiered market.

2. Simultaneously, the continuing decline of the US dollar relative to other currencies served to raise the prices offered (quoted in US dollars) by the traditional European sellers of non-DOE SWU. These sellers, intent on obtaining certain prices in their own currencies, have not been willing to rely on the fluctuations of the dollar. The continuing uncertainty over the validity of the Utility Services contract has reinforced the upward pressure on non-DOE SWU prices, and has eliminated some potential sellers of DOE SWU from the market. Finally, the possibility that USEC holders may be able to buy SWU on the spot market could create large quantities of new demand. This potential demand causes additional upward pressure on non-DOE SWU prices.

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CURRENT MARKET DATA

October 31, 1985	Market Values	Active Supply[1] (thousands)	Active Demand[1] (thousands)
EXCHANGE VALUE	**$16.50**/lb. U_3O_8	3,210	895
UF_6 VALUE	**$46.00**/kgU		
CONVERSION VALUE	**$1.60**/lb. U as UF_6	0	0
SWU VALUES			
DOE origin, certifiable as excess, 0.3 tails assay delivery by the end of FY86	**$83**/SWU		
Other SWUs (non-DOE or non-certifiable) delivery by the end of calendar year 1986	**$83**/SWU		
LOAN USE CHARGE RATE	**5%**/annum	2,000	0

	$/lb. U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
TRANSACTION VALUE	15.75	2.2	13	4

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[1] Supply and demand tables in the *Current Market Data* section of this Report detail the numbers for each category.

DEFINITIONS

1. The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.
2. The **UF_6 Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.
3. The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.
4. The **SWU Values** represent Nuexco's judgment of the price at which transactions for the sale of significant quantities of SWUs of stated origin for delivery in the specified time period could be concluded as of the date indicated.
5. The **Loan Use Charge Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.
6. The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
    a. Transactions closed within the previous three-month period for which delivery is scheduled within one year of the transaction date;
    b. At least ten transactions;
    c. Transactions involving a sum total of at least 2 million pounds U_3O_8 equivalent.

    The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

DERIVATIONS AND COMMENTS

1. All Market Values are based on:
    a. Data from recently completed transactions.
    b. Data from pending transactions.
    c. Firm bids to buy or borrow, and firm offers to sell or lend.
    d. Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed a willingness to offer, but for which Nuexco is not aware of firm offers to sell or lend.
2. Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not considered in the determination of these Market Values.
3. In the determination of the Conversion Value, Nuexco does not consider transportation charges other than those customarily provided by primary suppliers of conversion services.
4. The prices of conversion services or SWUs delivered under long-term contracts with primary suppliers are not considered in the determination of either the Conversion Value or SWU Value.
5. For the DOE SWU Values, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight-percent U_{235} and a product assay of 3.0 weight-percent U_{235}, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
6. In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminant variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

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CURRENT MARKET DATA

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
Country (currency)	**This Month (Oct. 31, 1985)**	**Last Month (Sep. 30, 1985)**	**12 Months Ago (Oct. 31, 1984)**	**This Month (Oct. 31, 1985)**	**Last Month (Sep. 30, 1985)**	**12 Months Ago (Oct. 31, 1984)**
Australia (dollar)	23.51	22.79	18.90	61.13	59.25	49.14
Belgium (comm. franc)	873.94	866.27	984.62	2,272	2,252	2,560
Canada (dollar)	22.55	21.98	21.08	58.63	57.15	54.80
Finland (markka)	92.54	91.90	101.59	240.59	238.92	264.10
France (franc)	132.32	130.61	149.39	344.00	339.56	388.39
FRG (mark)	43.43	42.94	48.69	112.91	111.64	126.59
Italy (lira)	29,188	29,154	30,177	75,882	75,795	78,454
Japan (yen)	3,507	3,458	3,927	9,119	8,991	10,210
Netherlands (guilder)	48.79	48.28	54.91	126.84	125.52	142.75
South Africa (rand)	42.04	40.30	30.59	109.29	104.78	79.53
Spain (peseta)	2,647	2,611	2,736	6,883	6,789	7,113
Sweden (krona)	129.62	128.51	139.13	336.97	334.11	361.71
Switzerland (franc)	35.56	35.15	40.06	92.45	91.38	104.15
UK (pound)	11.51	11.37	13.18	29.91	29.55	34.26
US (dollar)	16.50	16.00	16.00	42.90	41.60	41.60

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
Country (currency)	**This Month (Oct. 31, 1985)**	**Last Month (Sep. 30, 1985)**	**12 Months Ago (Oct. 31, 1984)**	**This Month (Oct. 31, 1985)**	**Last Month (Sep. 30, 1985)**	**12 Months Ago (Oct. 31, 1984)**
Australia (dollar)	22.45	21.51	18.96	58.35	55.92	49.29
Belgium (comm. franc)	834.22	817.54	987.69	2,168	2,125	2,568
Canada (dollar)	21.53	20.74	21.14	55.97	53.93	54.97
Finland (markka)	88.33	86.73	101.90	229.65	225.48	264.93
France (franc)	126.30	123.27	149.86	328.36	320.46	389.60
FRG (mark)	41.46	40.53	48.84	107.78	105.36	126.98
Italy (lira)	27,861	27,514	30,272	72,433	71,531	78,699
Japan (yen)	3,348	3,264	3,940	8,704	8,486	10,242
Netherlands (guilder)	46.57	45.56	55.08	121.07	118.46	143.19
South Africa (rand)	40.13	38.04	30.69	104.32	98.88	79.78
Spain (peseta)	2,527	2,464	2,745	6,570	6,407	7,135
Sweden (krona)	123.72	121.29	139.57	321.65	315.31	362.84
Switzerland (franc)	33.94	33.17	40.19	88.25	86.24	104.47
UK (pound)	10.98	10.73	13.22	28.55	27.89	34.37
US (dollar)	15.75	15.10	16.05	40.95	39.26	41.73

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on October 31, 1985.

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CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U as UF_6 This Month (Oct. 31, 1985)	per lb. U as UF_6 Last Month (Sep. 30, 1985)	per lb. U as UF_6 12 Months Ago (Oct. 31, 1984)	per kg. U as UF_6 This Month (Oct. 31, 1985)	per kg. U as UF_6 Last Month (Sep. 30, 1985)	per kg. U as UF_6 12 Months Ago (Oct. 31, 1984)
Australia (dollar)	2.28	2.28	1.18	5.03	5.02	2.60
Belgium (comm. franc)	84.75	86.63	61.54	186.83	190.98	135.67
Canada (dollar)	2.19	2.20	1.32	4.82	4.85	2.90
Finland (markka)	8.97	9.19	6.35	19.78	20.26	14.00
France (franc)	12.83	13.06	9.34	28.29	28.80	20.58
FRG (mark)	4.21	4.29	3.04	9.29	9.47	6.71
Italy (lira)	2,830	2,915	1,886	6,239	6,427	4,158
Japan (yen)	340.14	345.87	245.46	749.87	762.51	541.14
Netherlands (guilder)	4.73	4.83	3.43	10.43	10.64	7.57
South Africa (rand)	4.08	4.03	1.91	8.99	8.89	4.22
Spain (peseta)	256.74	261.14	171.00	566.01	575.71	376.99
Sweden (krona)	12.57	12.85	8.70	27.71	28.33	19.17
Switzerland (franc)	3.45	3.51	2.50	7.60	7.75	5.52
UK (pound)	1.12	1.14	0.82	2.46	2.51	1.82
US (dollar)	1.60	1.60	1.00	3.53	3.53	2.20

SWU VALUES AND UF_6 VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	DOE SWU Delivery by the End of FY86 (October 31, 1985)	Non-DOE SWU Delivery by the End of CY86 (October 31, 1985)	UF_6 Value per kg. U in UF_6 This Month (October 31, 1985)	UF_6 Value per kg. U in UF_6 Last Month (September 30, 1985)
Australia (dollar)	118.28	118.28	65.56	63.39
Belgium (comm. franc)	4,396	4,396	2,436	2,409
Canada (dollar)	113.45	113.45	62.88	61.13
Finland (markka)	465.51	465.51	257.99	255.60
France (franc)	665.50	665.50	368.89	363.27
FRG (mark)	218.48	218.48	121.08	119.43
Italy (lira)	146,824	146,824	81,372	81,086
Japan (yen)	17,644	17,644	9,778	9,619
Netherlands (guilder)	245.42	245.42	136.01	134.28
South Africa (rand)	211.47	211.47	117.20	112.09
Spain (peseta)	13,318	13,318	7,381	7,262
Sweden (krona)	652.00	652.00	361.35	357.43
Switzerland (franc)	178.88	178.88	99.14	97.76
UK (pound)	57.88	57.88	32.08	31.62
US (dollar)	83.00	83.00	46.00	44.50

[1] Calculated using currency exchange rates published in the *Wall Street Journal* on October 31, 1985.

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CURRENT MARKET DATA

RECENT TRANSACTIONS[1]

Uranium Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price as Percent of Current Exchange or UF_6 Value	Seller	Buyer	Remarks
3607	1986	301-600	109	Producer	European Utility	Not an arm's-length transaction.
3606	1985	101-300	see remarks	Canadian Producer	European Utility	Market-related price.
3605	1985	50-100	98	R[2]	Trader	
3603	1986	301-600	99	Trader	European Utility	
3579	1985	301-600	99	US Producer	US Producer	

[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] The notation *R* means that Nuexco either does not know, or that Nuexco has restricted that information to protect client confidentiality.

No secondary market sales of conversion or enrichment services are reported.

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CURRENT MARKET DATA

URANIUM SUPPLY
(October 31, 1985)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
2483*	70	—	
2654	300	700 per year	UF_6
2711*	70	—	
2728*	350	—	
2737*	120	200 per year	1986-92
2746	180	—	UF_6e
2764*	260	—	UF_6
2765*	260	—	UF_6
2793*	1,000	—	
2814	500	500	UF_6
2825*	100	—	
2263	—	400 per year	1987 on
2625*	—	500 per year	1987 on
2680*	—	500 per year	1986-92
2778	—	220 per year	1987-90
TOTAL:	3,210		
INACTIVE			
1860*	500	500 per year	UF_6
2335	275	—	
2336	250	250 per year	1985-94
2389	75	75 per year	1986-90
2705A	200	—	UF_6
2777	250	—	
2804	100	—	
2297	—	200 per year	1986-89
TOTAL:	1,750		

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*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2553, 2763, 2774.

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URANIUM DEMAND
(October 31, 1985)

	Delivery Period[1] (Thousands of Pounds U_3O_8)		
Nuexco Project Number	**Spot or Near-term[2]**	**Intermediate or Long-term**	**Remarks**
Inquiries to Purchase:			
ACTIVE			
2743	300	—	
2748*	75	75	
2762*	150	—	
2775	200	—	
2784	100	—	
2798*	70	—	
2217	—	1,000 per year	1989-95
2507	—	600	1987-89
2681	—	500 per year	UF_6 or U_3O_8; 1987-88
2741	—	600	
2733*	—	500 per year	1987-95
2753	—	200	1987
2758	—	500	UF_6
2760*	—	250	1986-90
2796	—	175 per year	1988-92
2808*	—	250	1989 on
TOTAL:	895		
INACTIVE			
2548	290	—	
2586	300	300 per year	1987-90
2767	200	—	UF_6
2786*	200	—	
2643	—	150 per year	1987 on
TOTAL:	990		

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*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2676, 2785.

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LOAN SUPPLY AND DEMAND
(October 31, 1985)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Within 1 Year	Beyond 1 Year	Remarks
Available for Loan:			
ACTIVE			
2805*	2,000	—	
TOTAL:	2,000		
INACTIVE			
1938*	2,000	—	UF_6
2036	500	—	
2667	800	—	
TOTAL:	3,300		

*New or revised since last month.
[1] Measured from the date of this Report.
Projects removed since last month: 2483, 2806.

No inquiries to borrow are reported this month.

CONVERSION SUPPLY AND DEMAND
(October 31, 1985)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U as UF_6) Within 3 Years	Beyond 3 Years	Remarks
Available for Sale:			
INACTIVE			
2051	100	—	
TOTAL:	100		
Inquiries to Purchase:			
INACTIVE			
2623	1,000	—	
2724	—	375	1989-93
TOTAL:	1,000		

*New or revised since last month.
[1] Measured from the date of this Report.
Projects removed since last month: 2587, 2709.

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CURRENT MARKET DATA

SWU SUPPLY
(October 31, 1985)

Nuexco Project Number	Delivery Period[1] (Thousands of SWUs) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
2410A	350	—	
2705	350	—	
2746*	100	—	
2571	—	55	1987
TOTAL:	800		
INACTIVE			
2652	—	25	1986
TOTAL:	0		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes SWUs deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2359, 2378, 2510, 2607.

SWU DEMAND
(October 31, 1985)

Nuexco Project Number	Delivery Period[1] (Thousands of SWUs) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Inquiries to Purchase:			
ACTIVE			
2400	—	150	1987-90
2742	10	—	
2752	65	—	
2761*	115	—	
2797*	—	150	1988-89
TOTAL:	190		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes SWUs deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2500, 2512, 2519, 2578, 2747.

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DENIAL OF FULL-COST RECOVERY: US UTILITIES' BIGGEST FRONT-END FUEL-CYCLE PROBLEM

Introduction

The rising incidence of regulatory authority denial of full-cost recovery for nuclear plant construction threatens the foundations of US utility financing. Industry attention has shifted away from licensing issues and toward the problems of investment return and cost recovery. Regulatory bodies and ratemaking authorities are requiring utilities to justify expenditures incurred in building a nuclear plant, not only in light of circumstances that existed at the time the expenditures were originally approved, but sometimes in the light of events that took place well after the fact. Not only are costs of canceled units at risk, but full-cost recovery is also being challenged for nuclear units that have entered commercial operation. At present, at least ten US utilities are threatened by prudence investigations for new nuclear units.

Nuclear plant construction projects are rarely completed under the original budget. A utility's financial condition often suffers as a consequence of having to raise substantially more capital than originally planned. The necessity for expensive external financing to complete plants facing delays and cost overruns has motivated many utilities to obtain short-term debt at high interest rates. As a result, without specific regulatory authority assistance in rates, utilities generally have reduced shareholders' earnings under these circumstances. The Public Utilities Commissions' (PUC) disallowance of cost recovery due to imprudency rulings may, for such utilities, preclude the appropriate and timely recovery through rates of the costs of service.

Utilities bringing new nuclear units into operation will almost certainly face cost-prudence investigations of some type as long as current circumstances prevail. Public utility commissions, the state governmental bodies that establish rates and settle cost allocation issues, are empowered to examine records and compel testimony covering all aspects of a plant's construction and management. They impose on the utility the burden of proof to establish that decisions were made and costs were incurred prudently at all stages of the project. PUCs typically justify cost disallowances based on determinations of inefficiency, negligence, imprudence, lack of sufficient records, inequitable sharing of risks between ratepayers and shareholders, etc. Some standards applicable to most states include the following:

1. Courts have held that regulatory commissions must balance investor and consumer interests.
2. The PUC has the duty to review and approve just and reasonable rates which the utility may charge its customers. Unjust or unreasonable charges are prohibited.
3. The utility usually bears the burden of proof to show that any rate increase is just and reasonable.
4. The PUC may consider all factors which have a bearing upon rates, with due regard to a reasonable return on rate base; in other words, a utility is entitled to a fair return on its prudent investment.

Unfortunately, there are few industry standards for management prudence in the construction of nuclear power plants. Because some projects have been relatively successful in controlling costs and others have experienced a multitude of problems and inefficiencies, computed average costs of construction are virtually meaningless as references for specific situations. In addition, it is not evident that average costs result directly from prudent management. The Missouri Public Service Commission, in examining Union Electric Company's Callaway plant, determined that "the complexity of a project does not address the question of management prudence."

The following are some recent examples of pending cases in which the disallowance of construction costs is at issue. Most of the cases have not been concluded or are undergoing lengthy appeals processes following cost disallowance. While this is not a comprehensive study, the situations described herein indicate the magnitude of the problem for electric utilities.

Major Disallowances

Shoreham—The New York State Public Service Commission (PSC) began a $4.3 million prudency investigation of Long Island Lighting Company's (LILCO) Shoreham plant in 1979. Two administrative law judges ruled in March 1985 that LILCO had lost effective control of the project's construction, and recommended that the PSC disallow $1.2 billion of the total cost as having been incurred imprudently. The PSC in June 1985 voted to disallow as imprudent $1.35 billion of the Shoreham unit's $4.5 billion cost, and not to allow LILCO to recover those funds from customers through rates. LILCO has not yet begun measures to appeal the decision, but is expected to challenge the ruling either through the PSC or state courts. At present, Shoreham is conducting low-power tests, and LILCO has submitted a request for costs to be phased into its rate base gradually over ten years.

Wolf Creek—Following eight weeks of hearings on the Wolf Creek unit, the Kansas Corporation Commis-

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sion (KCC) staff recommended that the Commission declare $447 million of the unit's construction costs imprudent. The staff recommended that the KCC prohibit the utilities involved, Kansas Gas & Electric Co., Kansas City Power & Light Co., and the Kansas Electric Power Cooperative, from collecting those costs through rates. KCC staff had retained a consulting firm to analyze the costs incurred at Wolf Creek, and the firm found that $447 million in costs could be attributed to "imprudent management actions or cost overruns attributable to causes which were controllable by owner management." Another firm retained by the Commission to review whether or not the project was worthwhile concluded that it was not economical to build a nuclear plant in Kansas, and that the plant will create excess capacity for all three utilities.

Later, the KCC staff proposed to allow only $21.5 million of a $90.5-million rate increase requested by Kansas City Power & Light, citing construction imprudence on the part of the utility. The staff also concluded that the decision to continue construction after 1981 was imprudent and recommended that the KCC deny the utility a return on $208 million in Wolf Creek expenditures that fell under Kansas jurisdiction.

Callaway—The Missouri Public Service Commission ruled that Union Electric Company did not adequately coordinate construction and engineering aspects at the Callaway site and denied part of a rate request. Union Electric had requested a $2.4 billion increase in rate base, on which rates to consumers were to be based, but the Commission denied $384 million (16 percent). The denial was based on the Commission's ruling that imprudent cost overruns had occurred, resulting from the allegedly erroneous perception that design work had progressed further at the start of construction than was actually the case. Union has appealed that ruling.

The Illinois Commerce Commission also disallowed $30.6 million of Callaway-related costs from inclusion in the Illinois jurisdictional rate base for Union Electric. That represented a 9.8-percent reduction from the amount requested by the utility in Illinois. The Illinois decision was not based on alleged imprudence or any one major factor, but incorporated elements of the Missouri decision.

Minor Disallowances

Seabrook—The Massachusetts Department of Public Utilities ruled that the Seabrook plant, owned by sixteen utilities led by Public Service of New Hampshire (35.6 percent), was "too risky" a project for ratepayers and has ordered the three Massachusetts utilities involved in the project to guarantee that shareholders will assume the risk of future investments in the plant. The utilities appealed the decision, but the Massachusetts State Supreme Court upheld the ruling. If Seabrook is completed, the utilities reportedly will be allowed to recover the plant costs as long as ratepayers do not pay more for nuclear-generated electricity than that from other sources.

Because the utilities with ownership in Seabrook are spread among five different states, jurisdictional problems complicate the Seabrook cost-recovery issue. Central Maine Power requested a $60-million rate increase, but the Maine Public Utility Commission allowed only $36 million in rate base, and stipulated that Maine ratepayers will pay no more for Seabrook power than that from other sources.

In addition to disallowance of costs representing plants in service, certain other costs have been disallowed by various regulatory bodies. Under current regulatory practice, the carrying costs incurred during utility construction generally are capitalized for later recovery from ratepayers during a plant's operating life. The practice is known as the allowance for funds used during construction (AFUDC) method. An alternate method for recovery is to include the cost of construction work in progress (CWIP) in the current rate base, thereby passing on to the ratepayers the PUC-allowed rate of return on such additional rate base (assuming all such capital costs are allowed in rate base).

Waterford—The Louisiana Public Service Commission rejected a rate base increase request for costs associated with Louisiana Power & Light Co.'s Waterford Unit 3. The request included $487 million for CWIP, and was rejected because the plant was not yet in commercial operation.

Perry—The Cleveland Electric Illuminating Company (CEI) asked to collect $40 million in CWIP funds through rates for its Perry Unit 1, but the Ohio PUC refused, citing construction delays, cost overruns, and skepticism that the plant will be in service within a year. CEI requested a $180-million rate increase, but was allowed to collect only $19.5 million. The PUC also denied CWIP funds for Perry to both Toledo Edison Co. and Ohio Edison Co., other owners of the plant. However, a motion calling for a rehearing regarding CWIP funds has been granted.

South Texas Project—The Texas PUC awarded Houston Lighting and Power a $168-million rate increase after it had requested $554 million for its South Texas Project Unit 1. The PUC excluded from the rate base all construction costs, as well as 12.4-percent interest on the

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$617-million CWIP costs the utility requested, because the utility failed to carry its burden of proof that the two-unit project had been managed prudently and efficiently. The utility has entered appeals in the courts. The PUC did include a CWIP allowance on $947 million, 47 percent of the utility's other construction progress, and granted a 16.3-percent rate of return on common equity (the utility had requested a 17-percent return). The PUC will hear arguments on the economic viability of STP Unit 2, and the findings could serve as a future determination of prudence. In January 1985 the PUC had excluded all STP-2 CWIP from the current rate base.

Susquehanna—The Pennsylvania PUC ruled that Pennsylvania Power & Light cannot earn a return on equity for its Susquehanna Unit 2. However, costs associated with depreciation, operation, and maintenance can be charged to ratepayers immediately. The PUC also stated that since 945 MWe of the 1,050-MWe reactor is excess capacity, ratepayers should not be charged for its construction. The utility has appealed the decision, but does not expect a resolution for at least a year.

Court Overrules PUC

Bailly—An Indiana appeals court ruling barred Northern Indiana Public Service Co. (Nipsco) from recovering costs associated with its abandoned Bailly plant after the Indiana Public Service Commission had approved it. The court set aside the PSC order allowing the utility to recoup a $190.7-million investment in the plant. Nipsco is expected to appeal to the Indiana Supreme Court. This ruling could affect Public Service of Indiana's attempt to recover its $2.34-billion investment in the canceled Marble Hill plant. PSI will seek amortization of Marble Hill costs despite the Nipsco decision.

No Disallowance

Two examples of units nearing operation which have been allowed full-cost recovery are Arizona Public Service's Palo Verde Unit 1 and Georgia Power Co.'s Vogtle. The California and Texas PUCs already have approved their shares of the Palo Verde plant and have allowed the costs to be borne by the ratepayers in their jurisdiction. The Georgia Senate passed a bill requiring the PSC to phase in over three to six years the estimated $7.2-billion cost of Vogtle. The House must also approve the bill.

Fuel-Related Prudency Issues

Public utility commissions increasingly are examining management prudency in areas other than construction costs. That increased scrutiny now extends to utilities' uranium costs and investments. This includes capitalization expenditures and investment returns for uranium exploration, development, joint venture projects, and supply contracts. Several recent rulings demonstrate that full-cost recovery of expenditures related to fuel procurement is not automatic.

The New York Public Service Commission (PSC) ruled in March 1984 that Niagara Mohawk Power Corporation could not recover from ratepayers the full cost of uranium it acquired through a joint-venture development project with a US producer. More recently, the commission refused to allow Long Island Lighting Company (LILCO) to charge ratepayers $11.3 million spent to maintain the Bokum Resources Corporation's uranium mine and mill in New Mexico. LILCO has invested $115 million in the joint-venture project, no part of which has yet been approved by the Commission for recovery through rates.

The California Public Utilities Commission is investigating the uranium purchasing practices of California utilities. Pacific Gas & Electric Company, Southern California Edison Company, and San Diego Electric & Gas Company were required by September 1, 1985 to respond to a questionnaire regarding spot uranium purchases and plans for future uranium contracts. The questionnaire also asked for the price of uranium offered and sold in available markets for the past five years, uranium price forecasts for the next ten years, and a summary of current contractual obligations between the utilities and their suppliers. The PUC will study the responses and a hearing is expected in January 1986 to determine a method for uranium cost recovery that can be applied in all cases.

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UPDATE

A CHRONOLOGY OF THE UTILITY SERVICES ENRICHMENT CONTRACT

The status of the Utility Services enrichment contract (USEC) is uncertain due to its recent invalidation by a federal court. The following chronology traces its evolution, beginning with its first publication in draft form. Significant enrichment market developments also are included.

August 1982

On August 21, 1982, the Fixed-Commitment Contract (FC) price, which previously had been $130.75 per SWU, was changed to $138.65 per SWU. The Requirements Contract price, which had been $144.15 per SWU, was changed to $149.85 per SWU. Secondary market SWUs for 1983 delivery became attractive to DOE 3.5-Year-Requirements Contract holders at $112 per SWU, minus a variable discount necessary to motivate buyers to act. The discounts ranged from $3 to $5 for DOE's Adjustable Fixed-Commitment (AFC) SWUs and $8 to $11 for Eurodif SWUs.

During the month of August, DOE issued the draft of the Facility Requirements (FR) Contract. The draft offered DOE customers greater flexibility. It included a three-year, rolling-commitment period, the low AFC SWU price, and high termination charges. However, the FR contract draft differed from the AFC contract in four important respects:

1. The FR contract had a shorter committed rolling period;
2. It included larger financial penalties for contract termination, such as full payments based on the estimated number of SWUs for a period of up to ten years in the worst case;
3. Requirements could be reduced through substitution of material originally enriched by DOE (as in the AFC contract) upon advance notice 30 months prior to the beginning of the year of delivery;
4. It allowed reduced advance payments.

DOE announced January 1983 as the final issue date for the contract.

January 1983

DOE announced that the FR contract would not be issued until July 1983.

June 1983

DOE entered private contract negotiations with two US utilities. The talks were canceled by DOE upper management because of legal and policy concerns.

July 1983

John R. Longenecker succeeded W. R. Voigt as Deputy Assistant Secretary for Uranium Enrichment and Assessment. DOE announced that the FR Contract would be issued in October 1983, not July. The draft had been reworked "extensively" and had a new name—the Utility Services Contract.

Over the past few years, it had become possible for holders of 3.5-year Requirements contracts to achieve substantial savings by participating in the developing secondary SWU market. The mechanism used was the partial termination of the Requirements contract. Even after paying the DOE termination charges (10 to 25 percent of the contract price per SWU), these buyers could purchase secondary market SWUs to replace their terminated DOE deliveries and still save enough money to justify the effort. So on July 25, DOE offered the Interim Sales Contract (ISC) to all 3.5-Year-Requirements Contract holders. The ISC essentially was a short-term, fixed-commitment contract modified to reflect a special 60-day payment term and 180-day notice on quantities and assays of feed and enriched product. It offered a price reduction of approximately $11.20 per SWU to any 3.5-Year-Requirements Contract holder willing to waive the right to terminate and agree to take all FY83 through FY85 SWU requirements from DOE. The price reduction was achieved by offering the fixed-commitment price ($138.65) instead of the Requirements price ($149.85). It also increased the payment term from 30 days to 60 days (except for deliveries that took place between August 1983 and September 1983).

In direct response to the ISC, secondary market SWU prices declined $11. The net commercial effect of the ISC was to make secondary market SWUs for 1984 delivery attractive to 3.5-Year-Requirements Contract holders at $101 per SWU, minus a variable discount of $3 to $5 for AFC SWUs and $9 to $12 for Eurodif SWUs. The ISC also put DOE in direct competition with their own customers, sellers of excess AFC SWUs.

October 1983

In addition to the ISC, DOE offered the Modified Interim Sales Contract (MISC) to all 3.5-Year-Requirements Contract holders. This contract was identical to the ISC except for the following provisions:

1. The holder could substitute 40 percent of 1984 reactor requirements and 60 percent of 1985 requirements at no charge, provided the substitute SWUs or

enriched uranium were of DOE origin and were not sold by a seller in order to buy non-DOE SWUs.

2. The holder agreed to convert to the Utility Services contract when it was issued.

AFC SWU prices on the secondary market rose to about $115 per SWU, but the DOE decision to offer the MISC further reduced the competitive price for non-DOE SWUs because it allowed DOE customers to partially substitute DOE SWUs without termination charges. Partial termination to buy non-DOE SWUs required the full payment of termination charges. Thus, because of the termination charges, non-DOE SWU prices declined to between $80 and $85 per SWU to remain attractive.

November 1983

DOE announced that the Utility Services contract would be issued soon. A meeting between DOE and the utilities' representatives was scheduled for December 20.

December 1983

Prior to the DOE meeting with utilities, there were rumors that a seller was offering AFC SWUs at $105 per SWU. This made the competitive non-DOE SWU price for 1984 delivery approximately $87 per SWU, minus the necessary additional incentive needed to motivate a buyer.

On December 20, 1983, US Energy Secretary Donald Hodel made a one-hour presentation to utility executives. He referred to the new contract as the "Requirements Contract." Although no details were given, the package was reported to include the following terms:

1. It would consist of one contract per utility as opposed to one per plant;
2. A percentage of requirements could be specified;
3. A variable tails assay option could be available at a cost;
4. There would be some sort of price protection;
5. The contract would contain termination provisions with higher charges for greater flexibility;
6. It would allow partial substitution for DOE SWUs at no charge.

Following the meeting, the utilities' chief concerns were the price mechanism, the terms of conversion to the new contract, and a schedule for a final contract offer. The DOE schedule was said to provide for a draft contract before year-end, a submission to Congress in mid-January, and a final issue date in February.

DOE sent the new Draft Utility Services Contract to its customers on December 30. The contract was essentially a requirements-type contract. The standard terms and conditions were much the same as those reported to utility executives by Secretary Donald Hodel on December 20. Some specifics included the following:

1. Current contract holders had to convert to the new contract by October 1984 in order to receive the terms and conditions contained therein.
2. AFC customers had to sign up for 100 percent of their requirements prior to 1987. After 1987, AFC customers could agree to take 70 to 100 percent of requirements. From the beginning, Requirements contract holders could sign up for 70 to 100 percent.
3. The ceiling price initially was set at $135 per SWU. DOE could adjust the basis for the ceiling on three years' advance notice.
4. Termination charges were prohibitively expensive.
5. The customer could change its percentage commitment plus or minus 10 percent with 10 years' advance notice.
6. Amounts and assays of enriched material were to be confirmed 180 days in advance of delivery.

It later became apparent that the process of acquiring Utility Services contract customers was being handled by DOE negotiators strictly on a case-by-case basis. Virtually all of the contracts were non-standard.

January 1984

DOE released a final draft USEC incorporating several important changes.

1. Customers had to *agree* to convert to the new USEC by October 1, 1984.
2. AFC contract holders could reduce their FY85 and FY86 SWU purchases by 10 and 25 percent, respectively.
3. Requirements contract holders could convert and *immediately* begin taking only 70 percent of requirements from DOE.
4. The lead time for changing the commitment percentage was reduced to five years.
5. Termination charges were reduced to zero upon 10 years' advance notice.
6. Requirements above the minimum commitment could be purchased from any source beginning in FY87.

February 1984

On February 6, Duke Power Company became the first utility to sign the new USEC. Duke was able to obtain extra relief from its old AFC contracts in that DOE agreed to allow Duke to substitute inventory consumption for SWU purchases at a rate greater than 30 percent of requirements in FY87.

DOE held a meeting in Oak Ridge, Tennessee to discuss operational plans, research and development, and the new USEC. Meanwhile, non-DOE primary enrichers began offering especially attractive contract terms in an effort to dissuade DOE customers from signing the USEC.

April 1984

On April 4, DOE announced FY85 prices of $153 per SWU for fixed-commitment customers and $157 per SWU for requirements customers. Industry sources speculated that the large price increases were part of an effort by DOE to force customers toward the USEC, which had a contract price of $135 per SWU.

August 1984

As one US utility signed a ten-year Eurodif enrichment contract, DOE publicized its consideration of filing anti-dumping charges to protect its market.

October 1984

Because more utilities converted to the USEC than anticipated, DOE began leaking information that the FY86 USEC price could fall to $125 per SWU, an action that served to depress secondary market SWU prices even further.

Unexpected support for the new contract materialized as DOE conducted case-by-case negotiations, as evidenced by the fact that only *two* customers converted to the standard USEC contract. All others negotiated special terms before converting. Table 1 summarizes the conversions.

Table 1

CONVERSION TO THE USEC
(By utility)

	Number of Customers	
	Converted	**Did Not Convert**
US Customers	45	5
Non-US Customers	27	10

It was reported that Cogema reached an agreement with the Eurodif shareholders to market their excess SWU commitments in order to bring order to the chaotic market in which the shareholders were competing with one another.

December 1984

Three US uranium producers filed suit against DOE in the US District Court in Denver. The main contentions were the illegality of the USEC contract and the failure of DOE to protect the domestic uranium industry as required by the Atomic Energy Act of 1954, as amended.

On December 27, the General Accounting Office (GAO) reported several irregularities in the USEC which may have violated the law, including:

1. The issuance of the new contract did not comply with the Administrative Procedures Act.
2. The price ceiling in the USEC was not authorized by the enrichment criteria.
3. Certain accounting procedures used to write down plant assets were misapplied.

January 1985

After months of negotiation, the Tennessee Valley Authority (TVA) and DOE reached an agreement whereby TVA would supply some cheaper off-peak power to DOE which, over a 10-year period, would reduce the DOE SWU price by about $0.37 per SWU.

February 1985

John Herrington replaced Donald Hodel as US Secretary of Energy.

April 1985

Martin Marrietta replaced Union Carbide as operator of DOE's Oak Ridge facilities and began to provide support to DOE's SWU marketing efforts.

DOE formally proposed an incentive pricing program to its enrichment customers. This program marked DOE's first attempt to compete directly with non-DOE SWU suppliers for that portion of its customers' requirements in excess of 70 percent under the USEC. Incentive SWUs were priced at $90 for FY87 and FY88, and $90 escalated for FY89 and FY90.

May 1985

In a declaration to the US District Court in Denver (as part of DOE's answer to the uranium producers' lawsuit), a DOE representative discussed the individual USEC conversion negotiations and stated that all but two of the converted contracts contained provisions materially different from the draft contract.

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June 1985

A trade association called the Uranium Producers of America (UPA) was formed. The new association's main goals were the enactment of effective mill tailings legislation and the recognition by the government of an obligation to ensure that a major share of US uranium requirements will be supplied by domestic production. (UPA later filed a supporting brief on behalf of the plaintiffs in the lawsuit against DOE.)

The results of DOE's Process Evaluation Board were released. The findings included the following:

1. The Atomic Vapor Laser Isotope Separation (AVLIS) process was to be DOE's choice for future enrichment capacity.
2. The Oak Ridge Gaseous Diffusion Plant was to be placed on indefinite standby.
3. The Portsmouth Gas Centrifuge Enrichment Plant (GCEP) project was to be abandoned.

September 1985

US District Court Judge Carrigan, ruling on opposing motions for summary judgment, declared the USEC null and void because the contract amounted to a change in the enrichment services criteria. Little market response was noted while utilities evaluated the effects of the decision. At least one utility temporarily withheld payment for future enrichment services.

DOE announced a FY86 SWU price under the USEC of $125 per SWU, and also announced a new, high-assay SWU price of $492 per SWU for enrichment over 10 weight-percent. The high-assay SWU price reflects the additional cost of operating the smallest two of DOE's five diffusion machine sizes. The weighted average price for high enriched uranium would vary between $125 and $134 for those utility customers with USEC contracts (which have a FY86 ceiling price of $134 per SWU). The SWU prices under Requirements or Fixed-Commitment contracts did not change.

October 1985

Assistant Secretary Longenecker warned that utilities should beware of seeking other sources of SWU supply in the wake of the court ruling of the USEC's invalidation. He said such utilities might later find themselves with two competing contracts.

The condition of the SWU markets at the end of October essentially was static as participants assessed the implications of the court ruling invalidating the USEC. Despite the ruling, many DOE customers have proceeded on the assumption that any one of the following possibilities will keep the USEC in effect:

1. A reversal of the Denver court ruling;
2. The inclusion of new procedural steps to overcome the identified problem areas in the contract; or
3. New legislation that would legitimize the contract.

While non-DOE primary SWU sellers have been cautious to avoid overt attempts to lure DOE customers away from DOE, the secondary market remains inactive because of buyers' unwillingness to make commitments until the prevailing uncertainties are resolved.

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RECENT DEVELOPMENTS

AUSTRALIA

The Olympic Dam (Roxby Downs) joint venture partners, Western Mining Co. and BP Australia Ltd., have appointed Kanematsu Gosho as sole agents for marketing Roxby Downs uranium in Japan. Uranium production at Roxby Downs is scheduled to begin in mid-1988. Kanematsu Gosho, though not one of the largest trading companies in Japan, has had a long-standing relationship with Western Mining Co. in conjunction with iron ore sales to steel mills in Japan. Previously, the trading company was the Japanese agent for sales from Yeellirie before that project was indefinitely deferred in 1984.

* * *

Energy Resources of Australia's (ERA) Ranger mine produced approximately 560 metric tons U_3O_8 (1,235,000 pounds U_3O_8) in the third quarter 1985, a 25-percent decline from the previous quarter. The drop was attributed to extended plant maintenance, the result of pushing the plant to maximum capacity performance levels in the second quarter. Despite the decline, ERA expects total production in 1985 to approach the plant's design capacity of 3,000 metric tons U_3O_8 (approximately 6,600,000 pounds U_3O_8) per year. Preparations for a 50-percent expansion have already begun. By 1988, annual U_3O_8 output will be 4,500 metric tons, approximately 10,000,000 pounds.

FEDERAL REPUBLIC OF GERMANY

Preussische Elektrizitaetswerk AG (PREAG) and Nordwestdeutsche Kraftwerk AG (NWK) merged on September 23, 1985, becoming the nation's second-largest utility. Rheinisch-Westfaelisches Elektrizitaetswerk AG (RWE) remains West Germany's largest producer of electricity. PREAG owned 69.9 percent of NWK prior to the merger. On November 19, the new utility officially will assume the name Preussenelektra AG, with headquarters in Hannover, Lower Saxony. The staff of NWK will relocate from Hamburg to Hannover by the spring of 1987.

The combined utility owns two nuclear power units outright and owns shares in five other units (Table 2). In addition, Preussenelektra manages the fuel supply for five of the units. Because the utility is a wholesaler of electric power, its customer base includes most of the regional electricity distribution companies in the northern and eastern parts of the FRG. It also serves several major industrial companies, including the automobile manufacturer Volkswagen AG. Figure 1 illustrates the service areas of the principal West German utilities. (See page 15 of Report 202, June 1985, for an article describing the nuclear fuel market infrastructure in the FRG.)

Table 2

PREUSSENELEKTRA'S OWNERSHIP IN NUCLEAR POWER UNITS

					Preussenelektra	
Unit	Other Owner	MWe (net)	Type	COD[1]	Percent Ownership	Share of Capacity (MWe net)
Wuergassen	—	640	BWR	Mar 1972	100	640
Unterweser	—	1,230	PWR	Oct 1979	100	1,230
Brokdorf[2]	HEW[3](20%)	1,290	PWR	Jun 1987	80	1,032
Stade	HEW (33%)	630	PWR	May 1972	67	422
Grohnde	GKW[4](50%)	1,290	PWR	Feb 1985	50	645
Kruemmel[5]	HEW (50%)	1,260	BWR	Mar 1984	50	630
Brunsbuettel[5]	HEW (67%)	771	BWR	Feb 1977	33	254
Total MWe Nuclear						4,853

[1] COD = Commercial Operation Date.

[2] The Brokdorf unit is under construction.

[3] HEW = Hamburgische Elektricitaetswerke AG.

[4] GKW = Gemeinschaftskraftwerk Weser.

[5] HEW manages the fuel supply for the Kruemmel and Brunsbuettel units.

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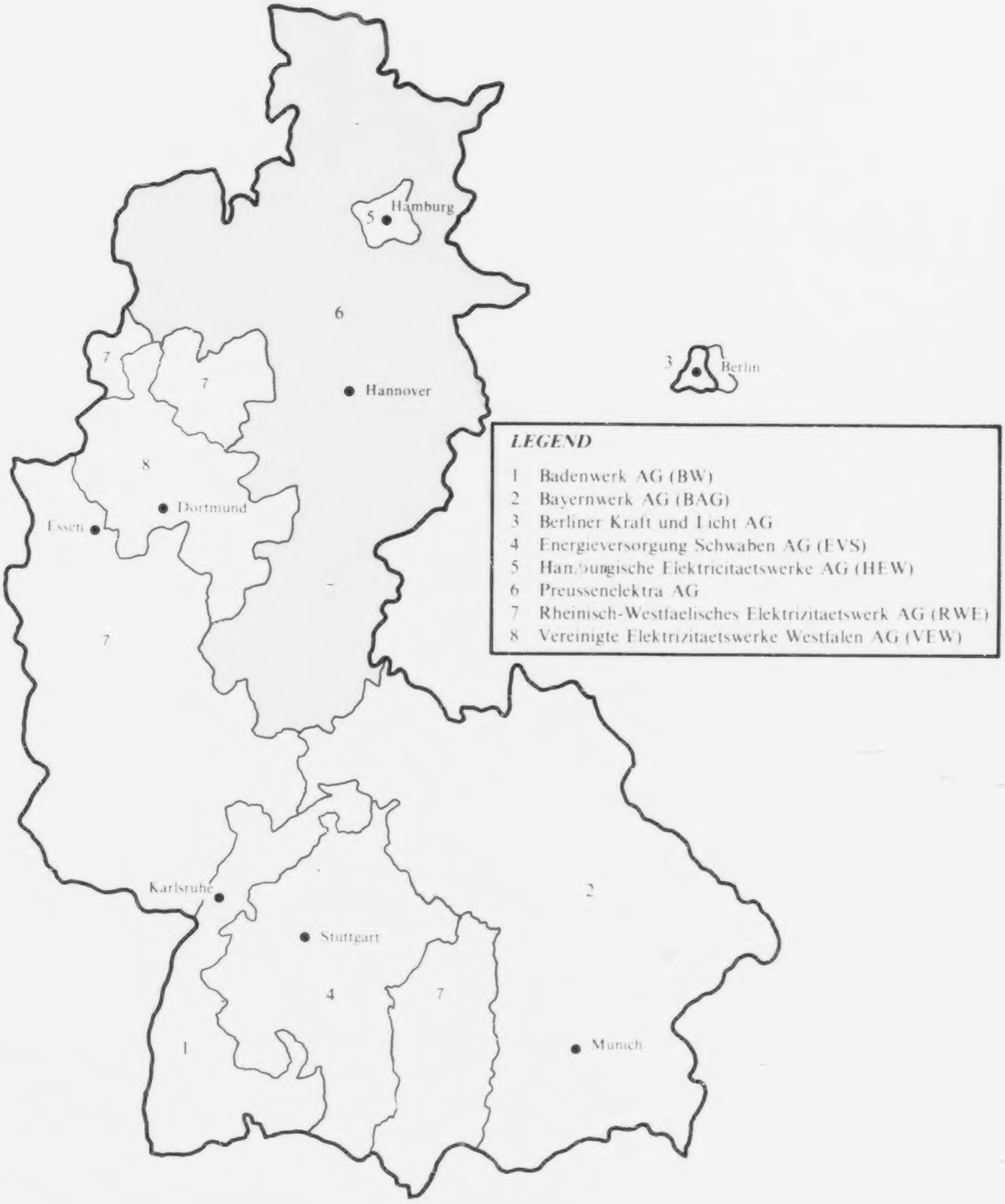
5
Hamburg
6
3
Berlin
7
7
Hannover
8
Dortmund
Essen
7
Karlsruhe
Stuttgart
2
4
7
1
Munich
LEGEND
1 Badenwerk AG (BW)
2 Bayernwerk AG (BAG)
3 Berliner Kraft und Licht AG
4 Energieversorgung Schwaben AG (EVS)
5 Hamburgische Elektricitaetswerke AG (HEW)
6 Preussenelektra AG
7 Rheinisch-Westfaelisches Elektrizitaetswerk AG (RWE)
8 Vereinigte Elektrizitaetswerke Westfalen AG (VEW)

Figure 1

SERVICE TERRITORIES OF PRINCIPAL WEST GERMAN UTILITIES
(Shading indicates Preussenelektra service territory)

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NUEXCO

RECENT DEVELOPMENTS

JAPAN

The US Department of Energy (DOE) has approached the Japanese Ministry of Trade and Industry (MITI) to solicit cooperation in the form of financial assistance for DOE's development program for laser enrichment. MITI agreed to establish a committee that includes Japanese utility participation to review DOE's request. It is expected that some degree of cooperation from Japan may result, although probably not on the scale suggested by DOE. MITI officials are considering the following factors:

1. The committee will examine the nature of any commercial benefits for the Japanese utilities if the private sector were to participate along with the government in providing financial assistance. While some have noted that utility participation could help to correct the current Japan-USA trade imbalance, the utilities are not motivated by that argument because they do not see themselves as contributors to the trade imbalance. In fact, Japanese utilities are chiefly importers, primarily of fossil fuels (though not necessarily from the USA).
2. Japanese utilities already have committed to participate in a private venture for construction of a domestic enrichment facility capable of supplying one-third of their enrichment needs by the turn of this century. This participation involves significant financial contributions.
3. The Japanese government and utilities are supporting their own laser enrichment development programs.

* * *

The Power Reactor and Nuclear Fuel Development Corporation (PNC), the government-affiliated organization in charge of several national programs for nuclear power, recently announced progress on some of its projects. PNC held ground-breaking ceremonies for the long-delayed Monju 280-MWe fast-breeder reactor. Initially scheduled for 1985 operation, PNC now plans to complete the project in 1992. Construction cost is estimated at 600 billion yen (approximately US$2.8 billion).

PNC also obtained final licensing review for a 200,000 SWU-per-year enrichment facility to be built in the Okayama prefecture. The plant will demonstrate on a commercial scale the centrifuge enrichment technology developed by PNC, and will serve as a prototype for a larger plant planned by the Japanese utilities in the Shimo-kita region in the northern part of Honshu (Nuexco Report 205). Construction of the prototype plant will begin in November 1985; the facility is scheduled to reach a 100,000 SWU capacity in 1987 and full capacity in 1988. Total cost of the prototype facility is estimated at 67 billion yen (approximately US$312 million).

* * *

Total nuclear generation capacity of the Japanese utilities increased to 23,631 MWe when Tokyo Electric Power Company's (TEPCO) Kashiwazaki Unit 1 (1,100-MWe BWR) began commercial operation. The unit, TEPCO's tenth nuclear unit (all BWRs), increased TEPCO's total nuclear generating capacity to 9,096 MWe, making it the world's largest private utility nuclear power program. TEPCO released several announcements regarding its program:

1. It has received licensing approvals for the use of higher efficiency BWR fuel designs. The new design, featuring a thin zirconium liner on the inside wall of the fuel rod tube, was developed in cooperation with BWR manufacturers Toshiba and Hitachi, and other BWR utilities (Chubu EPC, Chugoku EPC, and Tohoku EPC). TEPCO plans to phase the new fuel design into its reactors beginning in 1987.
2. TEPCO has reevaluated its policies related to fuel in-core management. Typical of Japanese utility practice, to date TEPCO has subcontracted this function to the reactor vendor, and the initial nuclear system supplier has provided reload fuel. TEPCO potentially could undertake core management in order to permit greater flexibility and competition in fuel supply.

* * *

Releasing results for the first half of fiscal year 1985 (April to September), the Japanese utilities announced near-record availability factors for their 30 operating nuclear power units. The combined availability was 72.8 percent, the third highest figure obtained to date for a similar six-month period. Of the 30 units, 29 are light-water reactors (15 BWRs and 14 PWRs), and one is a gas-cooled reactor. Shikoku EPC's Ikata Unit 2, a 566-MWe PWR, recently established a new Japanese performance record by operating for 416 consecutive days prior to a scheduled shutdown. The period exceeded the previous record, held by Kyushu EPC's Genkai Unit 2 (a 559-MWe PWR), by two days.

* * *

The government Agency of Natural Resources and Energy (ANRE) announced 1985 power generation costs for various types of electricity generation facilities. Costs were calculated for plants starting operation in 1985, and included costs for both the initial operation year and for lifetime operation, assuming 3-percent annual inflation. The results are tabulated in Table 3. Calculations do not include transmission and distribution-related facilities. Nuclear estimates do not include costs for future decommissioning or waste disposal. ANRE concluded that

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nuclear power continues to be competitive with other sources in both the near-term and the long-term. Table 3 also shows 1985 plant construction costs per kilowatt of installed capacity. Except for some escalation in LNG (liquid natural gas) facility construction costs, the results are essentially unchanged from a similar 1984 evaluation.

SOUTH AFRICA

Third-quarter uranium production from members of the Chamber of Mines amounted to 3,154,000 pounds U_3O_8, a 12-percent increase over the previous quarter (Table 4). The higher output can be attributed to the following:

1. A 42-percent increase in production at Vaal Reefs, at which total tons treated increased 29 percent and yield rose 15 percent.
2. Greater tonnage treated at Randfontein led to a 14-percent rise in production.
3. Chemwes (Stilfontein), Driefontein Consolidated, ERGO (East Rand Gold and Uranium Co.), and Hartebeestfontein all recorded higher outputs than in previous quarters in 1985.

Western Deep Levels ceased production during the second quarter of 1985, so there was no output in the third quarter, but sales from its stockpile continued to generate income. The cessation of production will reduce South Africa's annual output by approximately 400,000 pounds U_3O_8.

Because of labor unrest at the South Lease area of Vaal Reefs, second-quarter Vaal Reefs production was lower than usual. South Lease output doubled in the third quarter, returning Vaal Reefs to normal production levels. The short-lived strike by the National Union of Mineworkers (NUM) affected only two uranium mines, namely Hartebeestfontein and Driefontein. However, third-quarter uranium output increased at both mines, indicating that the strike, because of its short duration, had no demonstrable effect on uranium production.

Table 3

1985 ELECTRICAL GENERATING COSTS IN JAPAN[1]

	Net Generation Cost—Initial Year		Lifetime Generation Cost[2]		Current Construction Cost	
Source	**yen/kwh**	**(¢/kwh)**	**yen/kwh**	**(¢/kwh)**	**yen/kw**	**($/kw)**
Nuclear	13	(6.0)	12	(5.6)	310,000	(1,442)
Hydro	21	(9.8)	13	(6.0)	630,000	(2,930)
Oil	17	(8.0)	19	(8.8)	140,000	(651)
Coal	14	(6.5)	13	(6.0)	240,000	(1,116)
LNG[3]	17	(7.9)	19	(8.8)	210,000	(977)

[1] Costs converted from Japanese yen to US dollar at a rate of 215 yen per dollar.
[2] Assumes a three-percent inflation rate.
[3] LNG = Liquid Natural Gas.

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Table 4

REPUBLIC OF SOUTH AFRICA: 1985 URANIUM PRODUCTION[1]
(Thousands of pounds U_3O_8)

Operation	First Quarter 1985	Second Quarter 1985	Third Quarter 1985	Year to Date
Beisa (St. Helena)	0	0	0	0
Blyvooruitzicht	0	0	0	0
Buffelsfontein	401	378	366	1,145
Chemwes (Stilfontein)	148	148	160	456
Driefontein Consolidated	45	47	51	143
ERGO[2]	83	76	92	251
Harmony	256	225	225	706
Hartebeestfontein	239	222	243	704
JMS[3]	314	356	348	1,018
Randfontein	291	319	363	973
Vaal Reefs	1,156	799	1,137	3,092
Western Areas	150	189	171	510
Western Deep Levels	62	57	0	119
TOTAL[4]	3,145	2,816	3,154	9,115

[1] Excludes Palabora Mining Company, which is not a member of the Chamber of Mines.
[2] ERGO = East Rand Gold and Uranium Co. Ltd.
[3] JMS = Free State Joint Metallurgical Scheme.
[4] Columns may not add due to rounding.

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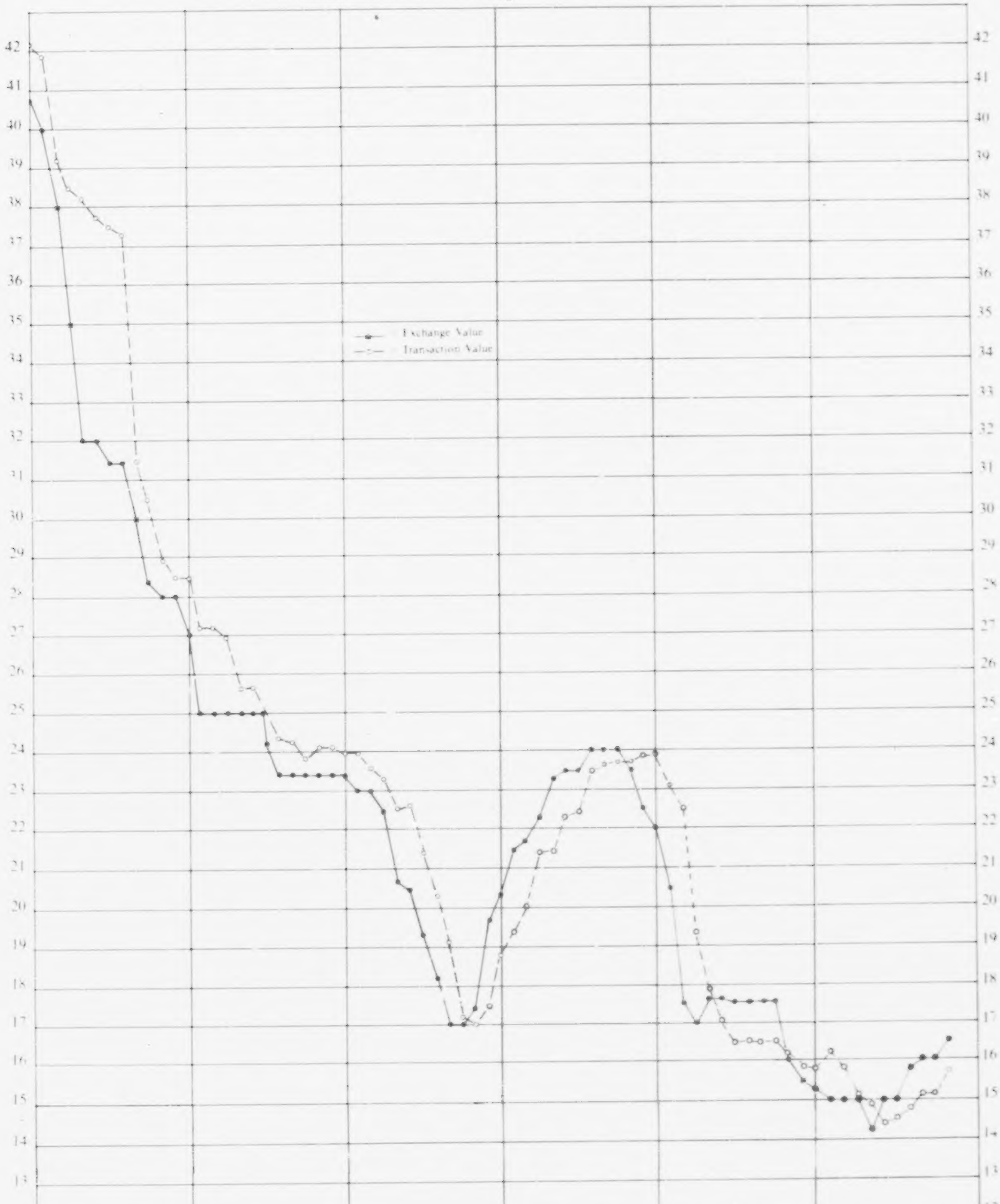
HISTORICAL MARKET DATA

EXCHANGE AND TRANSACTION VALUES SINCE JANUARY 1980

Determined as of the last day of the month indicated



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HISTORICAL MARKET DATA

HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	32.50	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	**16.50**		

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976				—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	**15.75**		

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U as UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	**1.60**		

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AUSTRALIA

GOVERNMENT STATISTICS

	Price Index of Materials Used in Manufacturing Industry—All Groups[1] (1969=100)	Award Rates of Pay Indexes Australia—Adult Males In Mining Wage and Salary Earners, Weekly Rates[2] (1976=100)
1983 Avg.	401.2	181.8
Jun 1984	404.7	197.4
Jul 1984	408.3	197.4
Aug 1984	413.1	197.4
Sep 1984	411.9	197.4
Oct 1984	408.4	197.4
Nov 1984	407.1	197.4
Dec 1984	406.0R	197.4
Jan 1985	409.4R	197.4
Feb 1985	416.0	197.4
Mar 1985	429.5R	197.4
Apr 1985	440.4R	202.3
May 1985	452.0R	202.3
Jun 1985	456.3	202.4
Jul 1985	455.5	202.3
Aug 1985	—	202.4

P = Preliminary R = Revised since last month

CANADA

	Industry Selling Price Index: Manufacturing[1] (1971=100)	Wage-earner Data: Average Hourly Earnings (C$)[2]					
		Uranium Mines (SIC 057)	Metal Mines* (SIC 051-059)	Mines, Quarries and Oil Wells[3] (SIC 051-099)	Primary Metal Industries Non-ferrous[4] (SIC 296)	Primary Metal Industries Non-ferrous[4] (SIC 298)	Chemicals and Chemical Products[5] (SIC 372-379)
1983 Avg.	298.8	—	—	14.30	—	—	11.17
Aug 1984	312.7	17.24	15.36	14.92	12.44	10.34	11.78
Sep 1984	312.3	17.68	15.96	15.34	12.51	10.52	11.90
Oct 1984	312.3	17.64	16.15	15.26	12.69	10.56	11.96
Nov 1984	313.6	18.04	16.13	15.43	12.47	10.51	11.96
Dec 1984	314.2	17.95	16.39	15.60	12.16	10.40	11.99
Jan 1985	315.8R	18.05	16.13	15.60	12.32	10.80	12.04
Feb 1985	316.5	18.78	16.41	15.68	12.52	11.05	12.06
Mar 1985	318.0	18.24	16.21	15.57	12.43	10.97	12.02
Apr 1985	318.2	18.63	16.44	15.80	12.81	11.23	12.04
May 1985	318.8	19.41	16.51	15.63	12.76	11.25	12.15
Jun 1985	319.0R	18.49	16.20	15.49	12.89	11.14	12.14
Jul 1985	319.2R	18.14	16.27R	15.41R	12.96R	11.17R	12.14R
Aug 1985	319.0R	17.56P	16.15P	15.39P	12.96P	11.17P	12.23P
Sep 1985	319.5	—	—	—	—	—	—

P = Preliminary R = Revised since last month

For annual averages prior to 1983, and for notes pertaining to these statistics, see pages 23-26 of Report 190 of June 1984.

* The 1980 average for Metal Mines was incorrectly reported as 10.59. The correct average is 10.58 (see Report 190).

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REPUBLIC OF SOUTH AFRICA

GOVERNMENT STATISTICS

	Average Declared Working Costs per per Metric Ton of Gold Ore Milled (Rand)[1]	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982=100)[2]	Consumer Price Index[3] (1975=100)[4]	Producer Price Index All Groups[5] (1975=100)	Total Employment in Mining and Quarrying (Code 35)[6]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[6]
1983 Avg.	51.87	115.0	262.2	274.8	696,579	3,644,772
Aug 1984	—	—	297.0	300.8	721,905	361,357
Sep 1984	60.64	133.2	299.9	304.1	721,470	359,218
Oct 1984	—	—	303.7	308.7	717,865	363,755
Nov 1984	—	—	307.4	312.8	717,396	369,771
Dec 1984	62.92	138.6	309.4	315.9	701,198	365,234
Jan 1985	—	—	177.1*	166.6*	711,366	376,777
Feb 1985	—	—	182.8*	171.3*	727,932	361,823
Mar 1985	64.48	142.4	183.6*	173.0*	708,809	371,380
Apr 1985	—	—	187.4*	174.0*	724,187	369,005
May 1985	—	—	189.5*	177.7*	708,085	373,478
Jun 1985	67.42	148.9	191.9*	179.2*	724,587	395,543
Jul 1985	—	—	193.6*	180.7*	738,228	419,106
Aug 1985	—	—	195.6*	183.2*	—	—
Sep 1985	—	—	197.8*	—	—	—

*The basis for calculation for these indices has been revised to January 1980 = 100.

UNITED STATES

	Producer Price Index[1]		Consumer Price Index[2]	GNP Implicit Price Deflator[3]	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4]			
	Industrial Commodities (1967=100)	All Commodities (1967=100)	(1967=100)	(1972=100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1983 Avg.	315.8	303.1	298.4	215.63	12.57	13.43	10.59	8.65
Aug 1984	323.5	310.9	313.0	—	13.10	13.51	11.13	9.00
Sep 1984	322.3	309.5	314.5	224.57	13.20	13.39	11.23	9.08
Oct 1984	323.2	309.4	315.3	—	13.23	13.53	11.32	9.09
Nov 1984	323.8	310.4	315.3	—	13.23	13.76	11.35	9.15
Dec 1984	323.0	309.9	315.5	226.10	13.28	13.66	11.37	9.27
Jan 1985	322.9	309.5	316.1	—	13.29	13.70	11.39	9.33
Feb 1985	322.5	309.2	317.4	—	13.30	13.73	11.39	9.33
Mar 1985	322.6	308.7	318.8	229.07	13.29	13.95	11.37	9.39
Apr 1985	323.8	309.3	320.1	—	13.43	13.62	11.48	9.40
May 1985	325.3	309.9	321.3	—	13.24	13.59	11.46	9.39
Jun 1985	324.7	309.1	322.3	230.53R	13.23	13.66	11.52	9.46
Jul 1985	324.3	309.0	322.8	—	13.45	13.82	11.60	9.47
Aug 1985	323.6	307.2	323.5	—	13.45	13.70	11.63	9.52
Sep 1985	322.5	305.8	324.5	232.44	13.45P	13.66P	11.69P	9.59P

P = Preliminary R = Revised since last month

For annual averages prior to 1983, and for notes pertaining to these statistics, see pages 23-26 of Report 190 of June 1984.

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REPRESENTATIVES AND CONSULTANTS

AUSTRALIA

Peter Stork
Oratom Consulting*
5 Gould Ave.
St. Ives
NSW 2075, Australia
Telephone: (61-2) 449-6783
Telex: 23976 (COMTLX)

JAPAN

Kazy Yokota
Japan Tech Services*
Ohkura Building (3F)
1-4-10 Shiba Daimon
Minato-ku, Tokyo, Japan
Telephone: (81-3) 431-6031, 6025
Telecopy: (81-3) 434-6674
Telex: 242-5060 (JATECH J)

SOUTH AFRICA

Chris I. Von Christierson
Southern Prospecting (Pty) Limited*
P.O. Box 61409
Marshalltown 2107
Republic of South Africa
Street Address:
10th Floor
Eagle Star House
70 Fox Street
Johannesburg 2001
Telephone: (27-11) 838-1868
(27-11) 834-4211
Telex: 4-89878 SA

TAIWAN

Edward Bee
Bee & Liang Company, Ltd.*
14 FL Universal Business Center
NO. 663, Tun Hwa South Road
P.O. Box 1396
Taipei, Taiwan R.O.C.
Telephone: (886-2) 704-9630
TWX: 785-11570 (BEELIANG)

UNITED STATES

Harold C. Lindberg*
83-A Hardee Lane
Whispering Pines, N.C. 28327
Telephone: (919) 949-3622

Ralph O. Smith*
141 Braemar Drive
Cheshire, Connecticut 06410
Telephone: (203) 272-6246

SPECIAL CONSULTANTS

James C. C. Stewart
U.K. Nuclear Industry

Claus C. Thiesen
Japan Nuclear Industry

W. Bryan Webster
International Business Development

J. Robert Wolcott
International Business Development

*Independent contractors representing Nuexco

NUEXCO

EXECUTIVE SUMMARY
REPORT 207
(All data as of October 31, 1985)

Exchange Value $16.50, up $0.50	The **Exchange Value** is **$16.50** per pound U_3O_8, up $0.50 since last month.
UF_6 Value $46.00, up $1.50	The **UF_6 Value** is **$46.00** per kilogram U as UF_6, up $1.50 since last month.
Transactions	Five recent natural uranium sales are reported, involving approximately 1.4 million pounds U_3O_8 equivalent. All of the sales involved spot or near-term delivery and three met the conditions for inclusion in the Transaction Value.
Supply-Demand Ratio rose to 3.6:1	Active spot and near-term **uranium supply** amounts to **3.2 million** pounds U_3O_8 equivalent, up 1.1 million pounds since last month. Active spot and near-term **uranium demand** totals **895 thousand** pounds, down 205 thousand pounds. The spot and near-term **supply-demand ratio** rose to **3.6:1.**
Transaction Value $15.75, up $0.65	The **Transaction Value** is **$15.75** per pound U_3O_8, up $0.65 since last month. The calculation includes 13 transactions involving a total of 2.2 million pounds U_3O_8 and equivalent UF_6, and covers a period of 4 months.
Loan Use Charge Rate unchanged at 5%	The **Loan Use Charge Rate** is **5 percent** per annum, unchanged.
Conversion Value unchanged at $1.60	The **Conversion Value** is **$1.60** per pound U as UF_6, unchanged since last month in a dormant market. No active secondary market supply or demand for conversion services for delivery within three years is reported.
SWU Values: $83 for DOE-origin for delivery by the end of FY86 $83 for non-DOE origin for delivery by the end of calendar year 1986	The **SWU Value** for DOE origin at .3 tails and certifiable as excess, is **$83** per SWU for delivery by the end of FY86. The SWU Value for other SWUs (non-DOE or non-certifiable) is **$83** per SWU for delivery by the end of calendar year 1986. No secondary market SWU transactions are reported.
Analysis & Commentary	The denial by Public Utility Commissions of utilities' full-cost recovery for nuclear power plant construction is surpassing regulation as the biggest front-end fuel-cycle problem for US utilities. Virtually all new units nearing completion or entering service will face prudency hearings, and must bear the burden of proof that design, construction, and fuel costs were prudently incurred.
Update	From its inception, DOE's Utility Services enrichment contract has had a major impact both on the uranium and the enrichment market worldwide. As a consequence of the recent invalidation ruling in a US District Court, the status of the contract is in doubt. This chronology traces the evolution of the USEC and the significant market developments associated with it.
Australia	The Olympic Dam partners have appointed Kanematsu Gosho, a Japanese trading company, as sole agents for marketing Roxby Downs uranium in Japan.
Federal Republic of Germany	Two of West Germany's utilities have merged to form the nation's second largest electric utility. PREAG and NWK have consolidated into Preussenelektra, which owns shares in seven nuclear power units.
Japan	The US DOE approached the Japanese government's Ministry of Trade and Industry (MITI) to solicit financial cooperation in developing commercial laser enrichment. MITI will evaluate the possible commercial benefits in light of its own plans to develop domestic laser enrichment programs.
South Africa	The Chamber of Mines has released third quarter 1985 uranium production figures; production increased 12 percent over the previous quarter.

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NUEXCO

NUEXCO REPORT 207 FIGURES OF THE MONTH (October 31, 1985)	This Month (Report 207)	Last Month (Report 206)	12 Months Ago (Report 195)
Exchange Value[1]	16.50	16.00	16.00
Transaction Value[1]	15.75	15.10	16.05
UF_6 Value[2]	46.00	44.50	—
Loan Use Charge Rate[3]	5%	5%	6%
Conversion Value[4]	1.60	1.60	1.00
Near-Term Uranium Supply[5]	3.2	2.1	5.5
Near-Term Uranium Demand[6]	0.9	1.1	1.3
Near-Term Supply-Demand Ratio	3.6	1.9	4.3
Recent Uranium Sales:			
Number of Transactions[7]	5	4	11
Quantity of Material[8]	1.4	0.3	1.6
Nuexco SWU Values:[9]			
DOE origin, certifiable as excess, 0.3 tails assay, delivery before the end of FY86	83	85	—
Other SWUs (non-DOE or non-certifiable), delivery by the end of calendar year 1986	83	78	—
USDOE SWU Prices:			
USEC	125.00[10]	125.00[10]	135.00
AFC	153.00[11]	153.00[11]	153.00[11]
Requirements	157.00[11]	157.00[11]	157.00[11]
Market Value of Enriched UF_6[12, 13]:			
2.5 w/o U_{235}	460	459	528
3.0 w/o U_{235}	591	589	683
3.5 w/o U_{235}	723	722	842
4.0 w/o U_{235}	858	857	1,003

---

[1] US $ per pound U_3O_8 equivalent.

[2] US $ per kilogram U as UF_6.

[3] Per annum.

[4] US $ per pound U as UF_6.

[5] Active inquiries to sell, for delivery within 12 months after contract signing (millions of pounds U_3O_8).

[6] Active inquiries to purchase, for delivery within 12 months after contract signing (millions of pounds U_3O_8).

[7] Uranium sales only; does not include loans, conversion, or SWU transactions.

[8] Millions of pounds U_3O_8, equivalent.

[9] US $ per SWU.

[10] Effective 10/1/85.

[11] Effective 10/1/84.

[12] Calculated using the Nuexco Exchange Value, Conversion Value, and 0.30 percent tails assay. From 3/30/84 through 4/29/85, calculations used the Nuexco SWU Value for DOE origin and FY85 delivery. As of 4/30/85, calculations use the Nuexco SWU Value for DOE origin and delivery by the end of FY86.

[13] US $ per KgU as UF_6, rounded to the nearest $.

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AMPLIFICATION

An item on page 1 of the *Pricing* section of this Report requires clarification. The item states, "The weakening of the US dollar against other currencies continued, causing the effective price of dollar-denominated uranium to rise in those currencies." In actuality, the weakening dollar has tended to *reduce* the price of uranium in non-US currencies, but the November rise in the Exchange Value (in US dollars) was large enough to increase the effective price of uranium in non-US currencies.

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MONTHLY REPORT

ON THE NUCLEAR FUEL MARKET

NUEXCO

HEADQUARTERS

Three Park Central
1515 Arapahoe Street
Suite 1045
Denver, Colorado 80202
Telephone: (303) 893-4015
Telecopy: (303) 825-4821
Telex: 450202 (NUEXCO DVR)

Managing Director
Oren L. Benton

NORTHEAST UNITED STATES

100 Prospect Street
Century Plaza South
Stamford, Connecticut 06901
Telephone: (203) 323-1999
Telecopy: (203) 325-1483
Telex: 4750124 (NUEXCO C)

Managing Broker
Earl E. Hoellen, Jr.

SOUTHEAST UNITED STATES

Suite 905
Ten Piedmont Center
Atlanta, Georgia 30305
Telephone: (404) 262-7375
Telecopy: (404) 233-6210
Telex: 4611142 (NUEX ATL)

Managing Broker
M. Jerry Reaves

WESTERN UNITED STATES

Building 3, Suite 290
3000 Sand Hill Road
Menlo Park, California 94025
Telephone: (415) 854-1510
Telecopy: (415) 854-2115
Telex: 470674 (NUEXCO UI)

Managing Broker
George White, Jr.

EUROPE

13 chemin du Levant
01210 Ferney-Voltaire
France
Telephone: (33-50) 428035
Telecopy: (33-50) 428526
Telex: 385288 (NUEXCO F)

Managing Broker
James E. Vaughan

REGIONAL MANAGING BROKERS

AFRICA
James E. Vaughan

AUSTRALIA
George White, Jr.

CANADA
Wayne D. Fowler

EUROPE
James E. Vaughan

FAR EAST
Christian C. Guitton

(See inside back cover for list of Representatives and Consultants)

NUEXCO

MONTHLY REPORT ON THE NUCLEAR FUEL MARKET
December 1985 No. 208

GEORGE WHITE, JR., *EDITOR* CLARK M. BEYER, *ASSOCIATE EDITOR*

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To Our Readers

Included with this Report is a slightly edited version of a speech presented by George White, Jr., at the Atomic Industrial Forum's Annual Conference in San Francisco, California on November 11, 1985.

* * *

Nuexco's US offices will be closed for the holidays on Wednesday, December 25, and Wednesday, January 1, 1986. Our Europe office will be closed from December 23 through January 1.

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NATURAL URANIUM AND SECONDARY MARKET CONVERSION

(All data as of November 30, 1985)

The **Exchange Value** is **$16.75** per pound U_3O_8, up $0.25 since last month. **Active supply** of natural uranium (U_3O_8 and UF_6) for spot or near-term delivery totals **3,615,000** pounds equivalent U_3O_8 as concentrates or UF_6, up 405,000 pounds since last month. The corresponding figure for **active demand** is **2,270,000** pounds, up 1,375,000 pounds. The spot and near-term **supply-demand ratio** fell to **1.6:1.**

The *Current Market Data* section of this Report lists one natural uranium sales transaction, involving approximately 100,000 to 300,000 pounds U_3O_8. It involved near-term delivery, and also met the criteria for inclusion in the current Transaction Value calculation. Several other transactions aggregating more than 300,000 pounds U_3O_8 were in the final stages of negotiation, but did not meet the criteria for reporting as of the end of the month.

The **Transaction Value** is **$15.80** per pound U_3O_8, up $0.05 since last month.

The **UF_6 Value** is **$46.00** per kilogram U in UF_6, unchanged since last month.

The **Conversion Value** is **$1.60** per pound U in UF_6, unchanged since last month. No active supply or demand of secondary market conversion services for delivery within three years is reported, and no secondary market conversion transactions are reported in that dormant market.

The **Loan Use Charge Rate** is unchanged at **5 percent** per annum, as both lenders and borrowers continue to express their interest in doing business at that level.

* * *

The Exchange Value rose slightly as overall market firming continued in this relatively quiet month. Lacking any downward pressure from distress sellers, the market edged higher as most sellers refused commitments at previous price levels. Some new demand entered the market, much of which was for longer-term requirements. Similar to last month, a wide range of offering prices is in effect; smaller quantities are available at slightly below $16.75, but larger quantities cannot be obtained at that level.

The UF_6 Value was unchanged, indicating that the availability of UF_6 continues to hold the price of UF_6 below the algebraic sum of the Exchange Value and Conversion Value. Based on the demand for and prices of U_3O_8, and the supply and prices of UF_6, it can be anticipated that *any* new demand for secondary market conversion services would likely be met through deconversion swaps at prices below the current Conversion Value, provided it is possible to match location and timing.

For the past several months, non-US currencies generally have risen against the US dollar. This trend was again evident during November. The slight rise in the Exchange Value (expressed in US dollars) did not overcome the dollar's decline, and the Exchange Value actually fell in most non-US currencies. The net effect was to discourage non-US sellers of spot or near-term material.

* * *

While the Exchange Value has advanced $2.50 per pound U_3O_8 from its April 1985 low of $14.25, it has yet to recover to the September 1984 level ($17.50) at which the present cycle began. Thus, while prices are up from their lows, reference to the Exchange Value graph on page 21 might suggest that prices are still at what could be described as "bargain" levels. Based on current spot price levels and attainable financing rates, it is easily calculated that it is more economical to purchase and hold uranium for use as late as 1990 or 1991 than to purchase the same material for delivery in those later years at currently attainable base prices plus assumed escalation. Presuming a reasonable level of market efficiency, this anomaly cannot continue indefinitely and will likely be the mechanism that will close the gap between spot prices and prices for longer-term delivery.

The two major uncertainties in the marketplace remain unresolved — the court decision ruling the US enrichment contract null and void, and DOE's finding that the US uranium industry is not viable. Litigation settlement proposals put forth by the US uranium producers have been rejected by DOE. To date the chief market response to these two events appears to be the attitudes of US producers, who have expressed renewed optimism regarding the future and are reluctant to enter transactions at current price levels. Conversely, utilities generally seem prepared to wait for these events to be resolved rather than taking action based on conjecture. It has been suggested that there may be some link between these events and recent inquiries by a number of utilities for long-term

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uranium supply. However, while the timing is somewhat coincident, these inquiries first began to appear some months ago, before the actions by the federal court and DOE, and are a predictable consequence of the general market perception that the prices were at or near their lows.

* * *

ENRICHED URANIUM AND SWUS

The Nuexco **SWU Values** as of November 30, 1985 are:

1. For **DOE origin,** a tails assay of 0.30 weight-percent U_{235}, for delivery by the end of FY86, and certifiable as excess, $78 per SWU, down $5.

2. For **other** SWUs (includes DOE origin SWUs not certifiable as excess and non-DOE origin SWUs), for delivery by the end of calendar year 1986, $78 per SWU, down $5.

One secondary market SWU transaction is reported this month, as both the DOE-certifiable SWU Value and non-DOE or non-certifiable SWU Value fell. Competition for the few remaining opportunities applied downward pressure on prices. Although some potential transactions currently are in negotiation, there is no active demand for SWUs in the near-term. Because of the convergence of the markets, any future supply of certifiable SWU will have to be marketed in competition with non-DOE origin SWU.

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CURRENT MARKET DATA

November 30, 1985	Market Values	Active Supply[1] (thousands)	Active Demand[1] (thousands)
EXCHANGE VALUE	**$16.75**/lb. U_3O_8	3,615	2,270
UF_6 VALUE	**$46.00**/kgU		
CONVERSION VALUE	**$1.60**/lb. U as UF_6	0	0
SWU VALUES			
DOE origin, certifiable as excess, 0.3 tails assay delivery by the end of FY86	**$78**/SWU		
Other SWUs (non-DOE or non-certifiable) delivery by the end of calendar year 1986	**$78**/SWU		
LOAN USE CHARGE RATE	5%/annum	2,000	0

	$/lb. U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
TRANSACTION VALUE	**16.25**	2.1	12	4

[1] Supply and demand tables in the *Current Market Data* section of this Report detail the numbers for each category.

DEFINITIONS

1. The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.
2. The **UF_6 Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.
3. The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.
4. The **SWU Values** represent Nuexco's judgment of the price at which transactions for the sale of significant quantities of SWUs of stated origin for delivery in the specified time period could be concluded as of the date indicated.
5. The **Loan Use Charge Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.
6. The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
   a. Transactions closed within the previous three-month period for which delivery is scheduled within one year of the transaction date;
   b. At least ten transactions;
   c. Transactions involving a sum total of at least 2 million pounds U_3O_8 equivalent.

   The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

DERIVATIONS AND COMMENTS

1. All Market Values are based on:
   a. Data from recently completed transactions.
   b. Data from pending transactions.
   c. Firm bids to buy or borrow, and firm offers to sell or lend.
   d. Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed a willingness to offer, but for which Nuexco is not aware of firm offers to sell or lend.
2. Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not considered in the determination of these Market Values.
3. In the determination of the Conversion Value, Nuexco does not consider transportation charges other than those customarily provided by primary suppliers of conversion services.
4. The prices of conversion services or SWUs delivered under long-term contracts with primary suppliers are not considered in the determination of either the Conversion Value or SWU Value.
5. For the DOE SWU Values, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight-percent U_{235} and a product assay of 3.0 weight-percent U_{235}, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
6. In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminant variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

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CURRENT MARKET DATA

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
Country (currency)	This Month (Nov. 30, 1985)	Last Month (Oct. 31, 1985)	12 Months Ago (Nov. 30, 1984)	This Month (Nov. 30, 1985)	Last Month (Oct. 31, 1985)	12 Months Ago (Nov. 30, 1984)
Australia (dollar)	24.31	23.51	17.99	63.20	61.13	46.77
Belgium (comm. franc)	861.18	873.94	959.16	2,239	2,272	2,494
Canada (dollar)	23.08	22.55	20.49	60.01	58.63	53.27
Finland (markka)	91.63	92.54	99.17	238.22	240.59	257.82
France (franc)	129.85	132.32	145.95	337.57	344.00	379.44
FRG (mark)	42.62	43.43	47.74	110.80	112.91	124.10
Italy (lira)	28,741	29,188	29,451	74,719	75,882	76,566
Japan (yen)	3,368	3,507	3,811	8,755	9,119	9,908
Netherlands (guilder)	47.82	48.79	53.65	124.31	126.84	139.48
South Africa (rand)	44.14	42.04	28.62	114.75	109.29	74.42
Spain (peseta)	2,625	2,647	2,663	6,825	6,883	6,923
Sweden (krona)	128.55	129.62	135.85	334.20	336.97	353.17
Switzerland (franc)	35.06	35.56	39.17	91.14	92.45	101.84
UK (pound)	11.41	11.51	12.88	29.66	29.91	33.50
US (dollar)	16.75	16.50	15.50	43.55	42.90	40.30

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
Country (currency)	This Month (Nov. 30, 1985)	Last Month (Oct. 31, 1985)	12 Months Ago (Nov. 30, 1984)	This Month (Nov. 30, 1985)	Last Month (Oct. 31, 1985)	12 Months Ago (Nov. 30, 1984)
Australia (dollar)	22.93	22.45	18.46	59.62	58.35	47.98
Belgium (comm. franc)	812.34	834.22	983.91	2,112	2,168	2,558
Canada (dollar)	21.77	21.53	21.02	56.60	55.97	54.65
Finland (markka)	86.43	88.83	101.73	224.71	229.65	264.47
France (franc)	122.48	126.30	149.72	318.42	328.36	389.23
FRG (mark)	40.20	41.46	48.97	104.52	107.78	127.31
Italy (lira)	27,110	27,861	30,211	70,481	72,433	78,542
Japan (yen)	3,177	3,348	3,910	8,258	8,704	10,164
Netherlands (guilder)	45.10	46.57	55.04	117.26	121.07	143.08
South Africa (rand)	41.63	40.13	29.36	108.24	104.32	76.34
Spain (peseta)	2,476	2,527	2,731	6,438	6,570	7,101
Sweden (krona)	121.26	123.72	139.35	315.25	321.65	362.28
Switzerland (franc)	33.07	33.94	40.18	85.97	88.25	104.46
UK (pound)	10.76	10.98	13.22	27.98	28.55	34.36
US (dollar)	15.80	15.75	15.90	41.08	40.95	41.34

[1] Calculated using currency exchange rates published in the *Wall Street Journal* on November 29, 1985.

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CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U as UF_6			per kg. U as UF_6		
	This Month (Nov. 30, 1985)	Last Month (Oct. 31, 1985)	12 Months Ago (Nov. 30, 1984)	This Month (Nov. 30, 1985)	Last Month (Oct. 31, 1985)	12 Months Ago (Nov. 30, 1984)
Australia (dollar)	2.32	2.28	0.93	5.12	5.03	2.05
Belgium (comm. franc)	82.26	84.75	49.51	181.36	186.83	109.14
Canada (dollar)	2.20	2.19	1.06	4.86	4.82	2.33
Finland (markka)	8.75	8.97	5.12	19.30	19.78	11.28
France (franc)	12.40	12.83	7.53	27.34	28.29	16.61
FRG (mark)	4.07	4.21	2.46	8.98	9.29	5.43
Italy (lira)	2,745	2,830	1,520	6,052	6,239	3,351
Japan (yen)	321.67	340.14	196.71	709.17	749.87	433.66
Netherlands (guilder)	4.57	4.73	2.77	10.07	10.43	6.10
South Africa (rand)	4.22	4.08	1.48	9.29	8.99	3.26
Spain (peseta)	250.78	256.74	137.43	552.88	566.01	302.99
Sweden (krona)	12.28	12.57	7.01	27.07	27.71	15.46
Switzerland (franc)	3.35	3.45	2.02	7.38	7.60	4.46
UK (pound)	1.09	1.12	0.67	2.40	2.46	1.47
US (dollar)	1.60	1.60	0.80	3.53	3.53	1.76

SWU VALUES AND UF_6 VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	DOE SWU Delivery by the End of FY86 (November 30, 1985)	Non-DOE SWU Delivery by the End of CY86 (November 30, 1985)	UF_6 Value per kg. U in UF_6 This Month (November 30, 1985)	UF_6 Value per kg. U in UF_6 Last Month (October 31, 1985)
Australia (dollar)	113.21	113.21	66.76	65.56
Belgium (comm. franc)	4,010	4,010	2,365	2,436
Canada (dollar)	107.48	107.48	63.39	62.88
Finland (markka)	426.70	426.70	251.64	257.99
France (franc)	604.65	604.65	356.59	368.89
FRG (mark)	198.47	198.47	117.05	121.08
Italy (lira)	133,837	133,837	78,929	81,372
Japan (yen)	15,682	15,682	9,248	9,778
Netherlands (guilder)	222.67	222.67	131.32	136.01
South Africa (rand)	205.53	205.53	121.21	117.20
Spain (peseta)	12,226	12,226	7,210	7,381
Sweden (krona)	598.62	598.62	353.03	361.35
Switzerland (franc)	163.25	163.25	96.27	99.14
UK (pound)	53.13	53.13	31.34	32.08
US (dollar)	78.00	78.00	46.00	46.00

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on November 29, 1985.

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CURRENT MARKET DATA

RECENT TRANSACTIONS[1]

Uranium Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price as Percent of Current Exchange or UF_6 Value	Seller	Buyer	Remarks
3616	1986	101-300	97	Trader	US Utility	

Enrichment Services
Secondary Market Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity[2] (thousands of SWUs)	Approximate Price[3] as Percent of Current SWU Value[4]	Seller Group	Buyer Group	SWU Origin	Remarks
3617	1986	less than 50	101-103	European Utility	US Utility	DOE	

[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] If tails assay is unknown or unspecified, Nuexco's calculation of SWU quantity assumes 0.30 w/o tails assay.

[3] Price is not normalized to 0.30% tails assay.

[4] Refers to SWU Value that corresponds to SWUs included in transaction. When prices and SWU values are expressed as discounts (e.g., X dollars less than DOE's USEC base price at time of delivery), the percentage refers to the ratio of the *discounts*, not the ratio of the prices.

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URANIUM SUPPLY
(November 30, 1985)

	Delivery Period[1] (Thousands of Pounds U_3O_8)		
Nuexco Project Number	**Spot or Near-term[2]**	**Intermediate or Long-term**	**Remarks**
Available for Sale:			
ACTIVE			
1860*	500	500	UF_6
2335*	275	—	
2483	70	—	
2728	350	—	
2737	120	200 per year	1986-92
2740*	200	—	
2771*	100	—	
2793	1,000	—	
2802*	200	—	
2814	500	500	UF_6
2907*	300	—	
2263	—	400 per year	1987 on
2625	—	500 per year	1987 on
2680	—	500 per year	1986-92
2778	—	220 per year	1987-90
2781*	—	100 per year	1988-95
TOTAL:	3,615		
INACTIVE			
2336	250	250 per year	1985-94
2389	75	75 per year	1986-90
2654*	300	700 per year	UF_6
2746*	180	—	UF_6e
2764*	260	—	UF_6
2765*	260	—	UF_6
2777	250	—	
2804	100	—	
2825*	100	—	
2297	—	200 per year	1986-89
TOTAL:	1,775		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2705, 2711.

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CURRENT MARKET DATA

URANIUM DEMAND
(November 30, 1985)

	Delivery Period[1] (Thousands of Pounds U_3O_8)		
Nuexco Project Number	Spot or Near-term[2]	Intermediate or Long-term	Remarks
Inquiries to Purchase: ACTIVE			
2743*	325	—	UF_6
2748*	75	—	
2758*	1,000	500	UF_6
2762*	300	—	
2769*	400	—	
2784	100	—	
2798	70	—	
2217	—	1,000 per year	1989-95
2507	—	600	1987-89
2586*	—	250 per year	1988-95
2681	—	500 per year	UF_6 or U_3O_8; 1987-88
2733	—	500 per year	1987-95
2738*	—	1,000	1989 on
2739*	—	1,000 per year	1987-90
2760	—	750 per year	1986-90
2770*	—	400 per year	1988-94
2796	—	175 per year	1988-92
2808	—	250	1989 on
TOTAL:	2,270		
INACTIVE			
2548	290	—	
2772*	750	—	
2786	200	—	
2806*	1,500	—	
2643	—	150 per year	1987 on
TOTAL:	2,740		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2741, 2753, 2767, 2775.

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LOAN SUPPLY AND DEMAND
(November 30, 1985)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Within 1 Year	Beyond 1 Year	Remarks
Available for Loan:			
ACTIVE			
2805	2,000	—	
TOTAL:	2,000		
INACTIVE			
1938	2,000	—	UF_6
2036	500	—	
2667	800	—	
TOTAL:	3,300		

*New or revised since last month.
[1] Measured from the date of this Report.
Projects removed since last month: None.

No inquiries to borrow are reported this month.

CONVERSION SUPPLY AND DEMAND
(November 30, 1985)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U as UF_6) Within 3 Years	Beyond 3 Years	Remarks
Available for Sale:			
INACTIVE			
2051	100	—	
TOTAL:	100		
Inquiries to Purchase:			
INACTIVE			
2724	—	375	1989-93
TOTAL:	0		

*New or revised since last month.
[1] Measured from the date of this Report.
Projects removed since last month: 2623.

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CURRENT MARKET DATA

SWU SUPPLY AND DEMAND
(November 30, 1985)

Nuexco Project Number	Delivery Period[1] (Thousands of SWUs) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
2410A	350	—	
2705	350	—	
2571	—	55	1987
TOTAL:	700		
INACTIVE			
2652	—	25	1986
2746*	100	—	
TOTAL:	100		
Inquiries to Purchase:			
INACTIVE			
2400	—	150	1987-90
2761	115	—	
2797	—	150	1988-89
TOTAL:	115		

---

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes SWUs deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2742, 2752.

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BELGIUM

Introduction

The final two units in Belgium's seven-unit nuclear power program recently have entered commercial service, ending that nation's nuclear construction phase. Belgium is the second European country to end its plant construction phase in 1985. (During 1985, Swedish utilities also commissioned the final two units in their twelve-unit program, Forsmark Unit 3 and Oskarshamn Unit 3.) Belgium's Doel Unit 4 and Tihange Unit 3 reached full power on June 20 and July 23, respectively. Both units are 980-MWe PWRs supplied by the consortium ACECON (comprised of Westinghouse and the Belgian companies Cockerill and Ateliers de Constructions Electriques de Charleroi SA [ACEC]). According to preliminary figures, during October 1985, the seven nuclear power units produced 80 percent of the country's electricity.

No plans for other units on Belgian territory have materialized to date, although the country's energy companies are discussing the installation of an eighth unit before the end of this century. In the interim, Belgian utilities and industrial groups are participating in the first unit of the Chooz B project under construction in northern France, in accordance with agreements reached in 1984 with Electricité de France (EDF) and French manufacturers. In recent decades, Belgium has been a strong advocate of European cooperation in economic and technical projects. Brussels is the seat of Euratom, the European Community's nuclear energy treaty organization, and Belgium is a participant in Eurodif and several other European nuclear energy projects. Like most countries in Europe, Belgium lacks adequate uranium resources. It imports a share of its requirements from each of the major uranium exporting regions of the free world.

Political Economy

The kingdom of Belgium is located in the center-west corner of Europe between the Netherlands, France, and the Federal Republic of Germany (Figure 1). The country has a population of 10 million, of whom some 59 percent speak Dutch and 41 percent speak French. The Doel nuclear power station is located in the Flemish (Dutch-speaking) region near the border with the Netherlands, and the Tihange station is located in the French-speaking region of Liege. Belgium is densely populated and heavily industrialized, having been for centuries a manufacturing and trading center. It is currently governed by a moderate parliamentary coalition of the Christian Democrat and Liberal parties.

Nuclear energy development began in the late 1960s following the progressive exhaustion of domestic coal resources and the rapid growth of electricity demand. The program was accelerated in the early 1970s due to the increasing cost of primary energy imports, oil products in particular. The first nuclear unit entered service in August 1975; by the end of 1985, the seven operating reactors will supply nearly 20 percent of all primary energy consumed in Belgium, and over 60 percent of total electricity consumed. The country now consumes only two-thirds the quantity of oil it used a decade ago.

Utility Structure

Table 1 lists Belgium's seven operating units, four of

Table 1

NUCLEAR POWER UNITS IN BELGIUM

Unit	MWe	Type	COD[1]	Operating Utility
Doel 1	392.5	PWR	Jan 1975	Ebes[2]
Doel 2	392.5	PWR	Dec 1975	Ebes
Doel 3	900	PWR	Sep 1982	Ebes
Doel 4	980	PWR	Jul 1985	Ebes
Tihange 1	870	PWR	Sep 1975	Intercom[3]
Tihange 2	900	PWR	Jun 1983	Intercom
Tihange 3	980	PWR	Oct 1985	Intercom
	5,415			

---

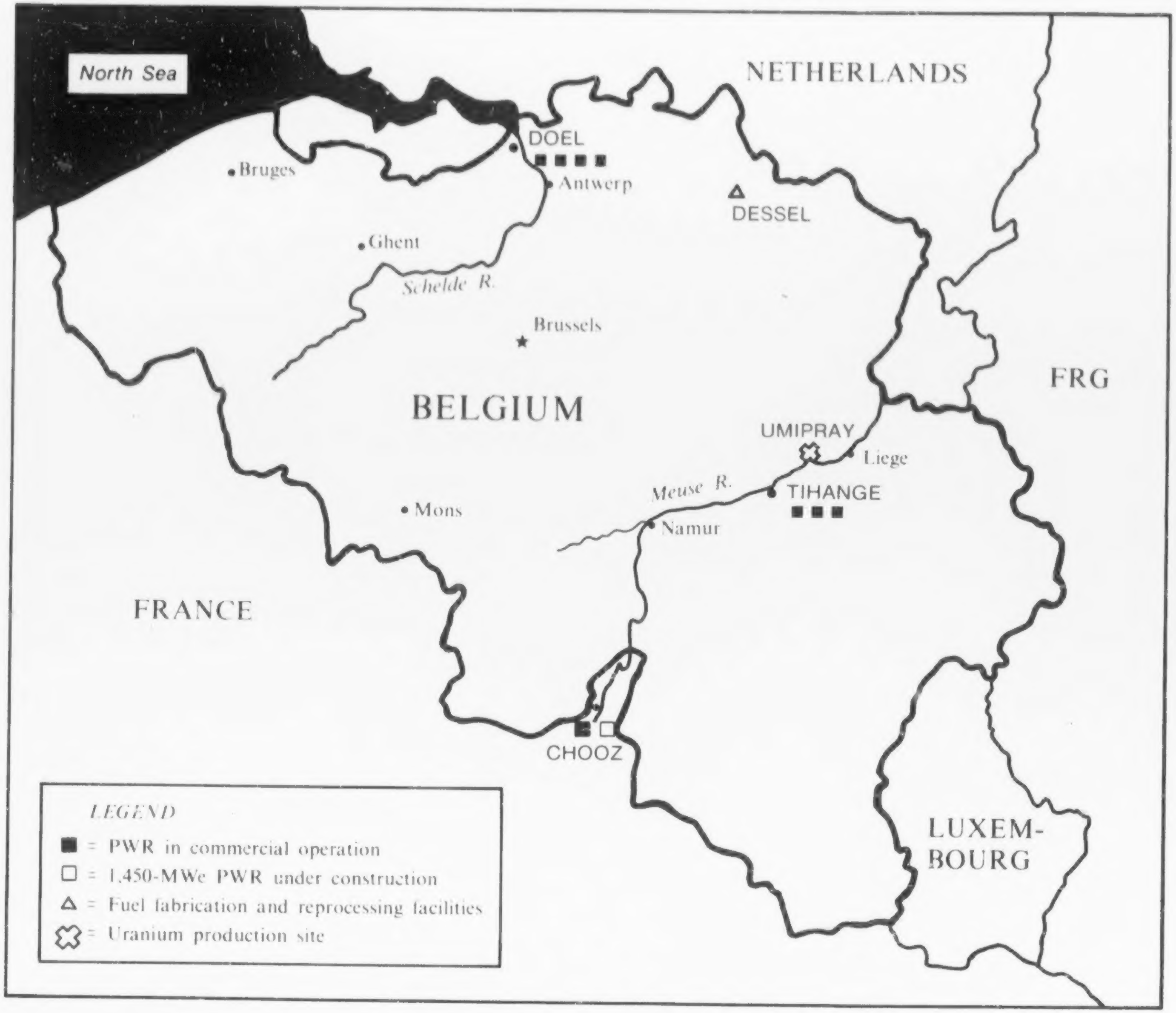
[1] COD = Commercial Operation Date.

[2] Ebes = Société Reunies d'Energie du Bassin de l'Escaut.

[3] Intercom = Société Intercommunale Belge de Gaz et d'Electricité.

Figure 1

NUCLEAR FUEL CYCLE FACILITIES IN BELGIUM


North Sea
NETHERLANDS
DOEL
Bruges
Antwerp
DESSEL
Ghent
Schelde R.
Brussels
FRG
BELGIUM
UMIPRAY
Liege
Meuse R.
TIHANGE
Mons
Namur
FRANCE
CHOOZ
LUXEM-
BOURG
LEGEND
■ = PWR in commercial operation
□ = 1,450-MWe PWR under construction
△ = Fuel fabrication and reprocessing facilities
✣ = Uranium production site

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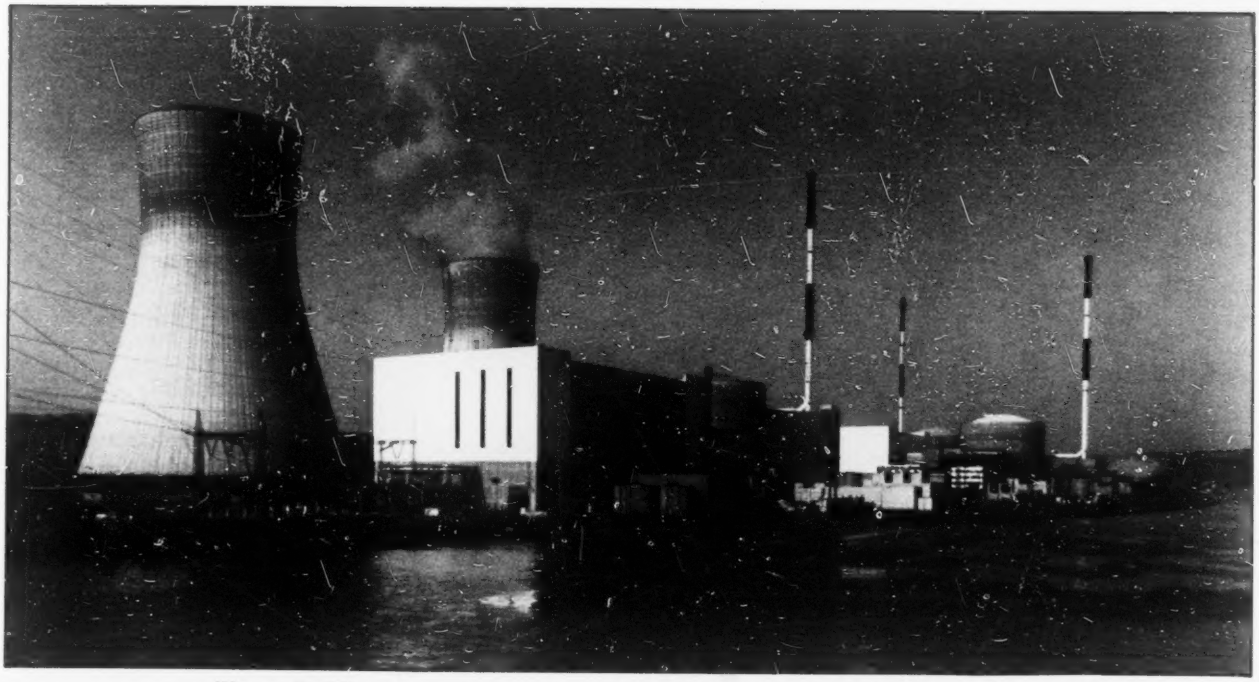

Figure 2. Tihange nuclear power station (2,750 MWe) on the Meuse River.

them located at the Doel station and three at the Tihange station (Figure 2). The principal owners of the units are the utilities Intercom (Société Intercommunale Belge de Gaz et d'Electricité), Ebes (Société Réunies d'Energie du Bassin de l'Escaut), and Unerg, which together produce approximately 95 percent of the electricity generated and consumed in the country. Intercom is the second largest company traded on the Belgian stock exchange; Ebes is the third largest, and Unerg the eighth largest. Ebes is the operating utility at the Doel station and owns the largest share in each of the station's four units; Intercom is the operator at Tihange, owning 100 percent of Tihange Units 2 and 3. EDF owns 50 percent of Tihange Unit 1, with the three Belgian utilities sharing the balance. The average capacity factor in 1984 for the five Belgian units then operating was 86.9 percent.

Belgium's two largest financial groups, Société Générale de Belgique (SGB), and Groupe Bruxelles Lambert (GBL), indirectly own large shareholdings in the three national utilities. Their shares are held through Tractionel and Electrobel, two holding companies with large electrical engineering divisions. The engineering division of Tractionel was the architect-engineer for all construction at the four-unit Doel station; the same division in Electrobel built the three-unit Tihange station. Tractionel and Electrobel are expected to consolidate activities in December 1985.

The Belgian utilities have cooperated with EDF in the Chooz A and B projects (Figure 1 and Table 2) as well as in Tihange Unit 1. Chooz Unit A, a 310-MWe PWR that began operation in 1967, is owned and operated by SENA (Société d'Energie Nucléaire Franco-Belge des Ardennes SA). SENA's shares are held jointly by EDF and the three Belgian utilities, in the same proportions as the ownership of Tihange Unit 1. In 1984 construction began on Chooz Unit B1, a 1,450-MWe PWR, after two agreements between Belgium and France were signed. Under one accord, the Belgian utilities will take 25 percent of the power from Chooz Unit B1 at cost, in exchange for selling at cost to EDF 50 percent of the power from the next Belgian unit. Under the second accord, 22.5 percent of the construction orders for Chooz Unit B1 are going to Belgian industry, in exchange for a similar arrangement for French manufacturers when the next Belgian unit is built.

The Belgian utilities also have an arrangement with EDF to take at cost 12.5 percent of the power from EDF's 3,660-MWe Tricastin station. That arrangement is part of Belgian ownership in the enrichment consortium Eurodif.

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Table 2

BELGIAN ELECTRICITY SHARES FROM EXTERNAL NUCLEAR POWER STATIONS

Station	Operating Utility	Percent Complete	Plant Capacity (MWe)	Belgian Share (percent)	Belgian Share (MWe)
Chooz A	SENA[1]	100	305	50.0	152.5
Chooz B1	EDF[2]	20	1,450	25.0	362.5
Tricastin	EDF	100	3,660	12.5	458.0
Kalkar	SBK[3]	90	295	14.5	42.8
TOTAL MWe					1,015.8

[1] SENA = Société d'Energie Nucléaire Franco-Belge des Ardennes.
[2] EDF = Electricité de France.
[3] SBK = Schnell-Bruter Kernkraftwerksgesellschaft mbH.

The Tricastin station, consisting of four 915-MWe PWRs, was built next to the Eurodif plant at Pierrelatte, France, in order to provide power to Eurodif's four large diffusion halls. (Eurodif is EDF's largest industrial customer, having the capacity to produce 10.8 million SWUs per year.) Each of the four international owners in Eurodif (Table 3) is entitled to a share of Eurodif production capacity that includes power from Tricastin. In another joint European venture, the Belgian government and private interests own 14.5 percent of the Kalkar SNR-300 Fast Breeder Reactor (FBR) project. British and Dutch interests, along with several West German utilities, are other owners in Kalkar. Kalkar is located on the Rhine River in the Federal Republic of Germany, near the border with the Netherlands.

Synatom

Fuel procurement for and management of the seven Belgian nuclear reactors (except for fabrication and in-core management) is handled by Synatom SA, located in Brussels. The Belgian nuclear fuel company was founded by the utilities in 1969 to coordinate a variety of nuclear power projects; in 1977, the articles of the company were modified to direct its focus to the nuclear fuel cycle. In 1983, the government acquired a 50-percent interest in Synatom through the state company SNI (Société Nationale d'Investissement). The current ownership is listed in

Table 3

OWNERSHIP OF EURODIF

Company	Country	Percent Share
Cogema	France	36.53
Sofidif[1]	France/Iran	25.00
Synatom	Belgium	11.11
Enusa	Spain	11.11
Agip Uranio	Italy	8.125
CNEN[2]	Italy	8.125

[1] Sofidif = Société Franco-Iranienne Pour l'Enrichissement de l'Uranium par Diffusion Gazeuse. Owners are Cogema (60 percent) and the Iran Atomic Energy Organization (40 percent). Cogema manages the Eurodif shareholding; the Iranian nuclear power program has been deferred since the 1979 revolution.
[2] CNEN = Comitat Nazionale per l'Energia Nucleare.

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Table 4. Synatom owns the nuclear fuel used in the Doel and Tihange stations before, during, and after burnup. All costs incurred by the company are paid by the Belgian utilities.

Table 4

OWNERSHIP OF SYNATOM

Company	Percent Share
SNI[1]	50
Ebes[2]	20
Intercom[3]	20
Unerg	10

[1] SNI = Société Nationale d'Investissement.

[2] Ebes = Société Réunies d'Energie du Bassin de l'Escaut.

[3] Intercom = Société Intercommunale Belge de Gaz et d'Electricité.

Aside from some small phosphate by-product production (40 MTU per year), Belgium produces no uranium domestically. Synatom conducts a policy of supply diversity, purchasing uranium under long-term contracts from mines in Australia, Canada, South Africa, and Central Africa. To date, the company has not made any direct investments in overseas production operations. Synatom's total requirements approach 900 MTU as U_3O_8 (2.3 million pounds) per year, and at least two years' forward consumption is kept in inventory. Most conversion requirements are covered by Comurhex, except for Canadian uranium converted at Eldorado and a small contract with British Nuclear Fuels Ltd. (BNFL). Synatom now takes almost all its enrichment requirements from Eurodif, though it still has a small supply contract with the USSR and three dormant Requirements-type contracts with the US DOE.

Synatom is also responsible for the storage and reprocessing of spent fuel. As of the end of 1984, approximately 1,200 spent fuel elements had been withdrawn from Belgian units, some 800 had been shipped to the Cogema plant at La Hague, and some 250 (90 MTU) had been reprocessed. Synatom has contracts with Cogema to reprocess between 500 and 600 MTU through 1990. The uranium recovered from reprocessing will be re-used in PWRs, while the plutonium will be used in mixed-oxide (MOX) fuel assemblies in PWRs or in the FBRs at Kalkar and Creys-Malville, France. The company Belgonucleaire, which has an ownership structure identical to that of Synatom, constructs MOX fuel assemblies at a plant in Dessel, Belgium. The plant has the capacity to produce 30 to 35 MTU as heavy metal (U and Pu) per year. Most of the standard fabrication for the Belgian PWRs is done by FBFC (Société Franco-Belge de Fabrication de Combustible), a Westinghouse licensee that operates a plant at Dessel with a capacity of 400 MTU per year.

Belgium's Eurochemic reprocessing facility, also located at Dessel, has been out of service since 1974. The government voted in 1983 for bring the plant back into operation for commercial use by Synatom. Synatom has created a subsidiary called Belgoprocess to develop the domestic operation, and is cooperating in this endeavor with Cogema and the German company DWK (Deutsche Gesellschaft fur Wiederaufarbeitung von Kernbrennstoffen mbH). The Eurochemic facility could be in operation around 1990. Final waste disposal in Belgium is regulated by ONDRAF (Organisme National des Déchets Radioactifs et des Matières Fissiles), a government agency created by law in 1980 and funded by the utilities. A waste vitrification demonstration plant has been built by a German group at Dessel, but the issue of final waste storage in Belgium is still undecided.

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AUSTRALIA

Under the joint venture agreement between Western Mining Corporation and BP Australia, a decision is due by December 7, 1985 both on the final commitment to develop the Olympic Dam (Roxby Downs) project and on the project's construction schedule. While it has been expected the partners would commit to the project at that time, it has been suggested the commitment date may be delayed to allow the partners additional time to secure contracts for the uranium output. It has been widely reported that the Australian floor price (approximately US$31.00) was proving a serious limitation to concluding uranium sales from the project. Consequently, there were reports that officials were considering eliminating the floor price, lowering it, or reinterpreting it in some fashion that would ease the concerns of potential buyers. As might be expected, Australian government sources characterized such reports as being without foundation. A positive decision to proceed with the Olympic Dam project would lend important support to the South Australian government, which faces an upcoming election. Recently the state government granted the partners special license to draw water from the Great Artesian Basin to meet initial project requirements.

The Director General of the European Commission responsible for energy, on a recent visit to Australia, commented that Australia could be filling one-quarter of the EC's uranium needs by the end of the century. By present estimates this projection would require Australian sales in Europe to increase from 2 million pounds to 8 million pounds U_3O_8 per year. (Table 5 shows Australian uranium production and export figures for the past three financial years.) This would clearly suggest the startup of Roxby Downs production, provided the buyers can be assured that Australia will be a reliable long-term supplier. The floor-price policy and the government-imposed moratorium on uranium exports to France undoubtedly have caused some European buyers to regard Australian supply with serious reservations.

Table 5

AUSTRALIAN PRODUCTION AND EXPORT
(Millions of pounds U_3O_8)

Financial Year Ending June 30	**Production**	**Export**
1984-85	9.54	7.53
1983-84	9.66	7.40
1982-83	10.10	9.26

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SURFICIAL URANIUM DEPOSITS—PART 1

The worldwide search for uranium has resulted in the discovery and recognition of many unconventional uranium occurrences. This is the first of a two-part article on surficial uranium deposits.

Introduction

Surficial uranium deposits occur in a variety of geologic environments dated from Tertiary to Recent ages. These deposits were essentially overlooked by early explorationists because of unusual geologic and mineralogic characteristics. One characteristic is *associated radioactive disequilibrium*, a condition that can occur in deposits when uranium accumulation is so recent that the breakdown of radioactive daughter products, principally Radium 226, is incomplete. The level of radioactive equilibrium in the Tertiary deposits varies widely, from about 0.40 to 1.20, where 1.00 represents equilibrium. In more recent deposits the equilibrium factor may be as low as 0.05 to 0.10. Thus, in young deposits the presence of uranium is virtually undetectable using conventional field instruments. In addition, there is no visible evidence of mineralization. Different exploration techniques are necessary for the discovery and delineation of surficial deposits, especially when dealing with deposits of recent age.

A typical deposit is formed in sediments by precipitation, evaporation, and adsorption on organic matter in swamp environments. Mineralized solutions migrating through favorable host material serve as the uranium source in each deposit. Many of these deposits are still developing as the ore-forming process continues; similarly, changing climatic and geologic conditions can deplete surficial deposits. Under some circumstances, the depletion process at one deposit can enhance the development of a new deposit in another location where the mineralizing process may occur under different host conditions.

The existence of surficial uranium has only recently been identified at locations throughout the world. The discovery and detailed studies of the Yeelirrie deposit in Western Australia during the early 1970s resulted in recognition of the economic potential of surficial deposits. Subsequent discoveries were made in Namibia and South Africa, northern Africa, and South America. The first discoveries in North America were recorded in the early 1970s.

Classification of Surficial Deposits

Surficial uranium is found in at least four general geomorphic and climatic settings—arid, wet temperate, tropical, and transitional. Each is further divided into one or more settings specific to local environmental conditions. Any combination of uranium occurrences may be found within a particular controlling environment, so the potential number and type of deposits are extensive. A general classification of surficial uranium deposits is listed in Table 6.

Surficial deposits are further classified by geologic age. Almost without exception, the deposits occur in Tertiary to Recent sediments. The most important deposits are in extremely arid lands and are of Late Tertiary age, followed by lesser deposits in the temperate wetland and tropical environments of Late Tertiary to Recent age. Finally, the youngest and smaller deposits are found in the transitional environments, usually in organic-rich material associated with unconsolidated sediments within a temperate wetland environment of Recent age. Negative radioactive disequilibrium is often common to deposits in all age environments. It varies with age and depositional characteristics of the uranium, but generally, chemical uranium assay values exceed radioactive equivalent uranium.

Uranium Source

Close proximity to uranium-bearing source rocks is required for the formation of surficial uranium deposits. Intrusive basement rocks consisting mainly of granites and metamorphics usually contain well-disseminated uranium in trace amounts. The average uranium content of granites may vary from about 2 to 8 parts per million (ppm), but locally may be many times higher. The uranium content of metamorphic rocks is less consistent than that in granites, but may occur locally in high-grade concentrations. Finally, through the favorable composition of basement source rock, geomorphology, hydrology, geochemistry, and climate, uranium is leached gradually from the source rock and transported to a favorable host environment where uranium accumulation takes place.

Uranium accumulation occurs by any of three methods—precipitation, evaporation, or adsorption. The uranium in almost every case is found in the hexavalent form, resulting from highly oxidized or reducing conditions. Precipitation of uranium more commonly occurs at the interface of subsurface mineral-bearing solutions and a favorable host environment. Uranium accumulation (or depletion) may be a continuous process subject to subtle physical and chemical changes. Changing climatic conditions, especially prolonged dry periods, hasten mineral precipitation. Mineral depletion and reconstitution are influenced by wet climatic conditions and related fluctu-

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ating water levels.

Companion minerals (vanadium, potassium, molybdenum, etc.) will precipitate out with the uranium and may complicate the uranium deposition/depletion sequence, as well as hampering the recovery process. The most important uranium mineral to form under such conditions is carnotite, a hydrous potassium uranyl vanadate.

Calcrete deposits are foremost examples of surficial uranium deposits formed by the process of precipitation and evaporation in a fluviatile environment. Evaporative uranium is less common than precipitated uranium; however, the latter occurs in playa environments where arid climatic conditions are extreme. Wet periods followed by long dry periods enhance the evaporative process. Surface waters become charged with uranium following initial contact with source rocks, passing into a playa containment area. Evaporation of the water begins immediately and mineral concentration occurs. In addition, uranium carried in ground waters may be brought to the surface through capillary action to replace water lost during evaporation, becoming a secondary source of uranium. Evaporative minerals usually form in thin layers and may be interbedded with debris (sand and silt) carried into the playa each time it is recharged during the wet season.

Table 6

GENERAL CLASSIFICATION OF SURFICIAL URANIUM DEPOSITS[1]

Climate	Environment	Characteristic
Arid	*Fluviatile*	Stream development
	Valley-fill	Channel deposition
	Flood plain	Deltaic/alluvial fan
	Playa	Evaporite basin
	Marsh/bog	Fine sediments/organics
	Pedogenic	Soil profile
	Authigenic	Soil weathered in-place
	Allogenic	Weathered, redeposited
Wetland	*Fluviatile*	Stream development
	Valley-fill	Channel deposition
	Flood plain	Deltaic
	Springs	Deep groundwater source
	Peat/bog	Organic-rich sediments
	Lacustrine	Lake sediments
	Swamps	Marginal accumulation
	Peat/bog	Organic-rich sediments
Tropical	*Lateritic*	Weathered source rocks
	Supergene	Enriched primary ore
	Epigenetic	Filled fractures/joints
	Gossans	Alteration profile
	Supergene	Enriched primary ore
	Epigenetic	Enriched iron/sulfide ore
Transitional	*General*	Combination of deposits
	Peat, bogs, marshes, swamps, etc.	Organic-rich sediments, low radioactivity

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[1] Classification table adapted from IAEA-TECDOC-322, Surficial Uranium Deposits, 1984, pages 10 and 244.

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Any soluble substance contained in the waters will accumulate at the surface as an evaporite or a brine, and may be of economic interest separately or as a by-product. Associated complex salts can influence the process of uranium accumulation, depletion, and reconstitution. Uranium deposits formed by evaporation are usually thin (one to two meters) and may be well stratified with barren sediments. Nevertheless, lateral limits can be extensive. Identification of uranium minerals in evaporative deposits is rare due to the unstable environment; however, schroeckingerite, a water-soluble uranyl carbonate, has been recognized in unconsolidated sediments following hot and dry periods at Lost Springs, in the Red Desert of Wyoming.

The recent surficial uranium deposits are still forming in today's transitional climates (wetlands) where wet and dry seasons prevail. Uranium-charged surface and ground waters pass through shallow unconsolidated sediments containing an abundance of organic debris in a reducing environment. The organic matter may accumulate as a layer of peat, consisting of decomposed logs, leaves, grasses, and moss, or as pieces or matter scattered throughout sediments. As the uranium-bearing solutions filter through, uranium becomes attached to the organic matter through adsorption.

Uranium accumulation may begin at grass roots and extend for several meters downward through the favorable host material. However, uranium is only loosely bonded to the organic matter, resulting in continuous deposition and remobilization. New mineral accumulations occur wherever favorable environments are encountered downstream. In a case of rapidly fluctuating water levels, precipitation of uranium may occur in the fine to medium-grained sediments. Discrete uranium minerals have not been recognized in any deposits, although associated minerals molybdenum and vanadium have been identified in a few. The geologic age of active, organic-related deposits is estimated to be within the last 10,000 years.

Mode of Occurrence

The largest and most stable surficial uranium deposits are found in arid climates in a geologic environment of shallow Tertiary sediments comprised of indurated sand and gravel. Locally, soil accumulations may become part of the favorable environment. The host rock is designated a calcrete due to a calcium carbonate cementing agent precipitated during solution migration. The degree of cementation varies considerably according to the nature of sediments contacted and the geologic stability of the area of interest. A mature calcrete deposit may show layering and vertical zoning of cemented material caused by fluctuations in solution activity due to climatic changes or tectonic adjustments. Other cementing minerals that may further complicate (or moderate) the makeup of a surficial deposit include dolomite, gypsum, ferric oxide, and halite, any one of which can develop independently of calcium carbonate.

The formation of surficial uranium deposits outside of arid climates occurs by the same basic processes. The principal controls are geology, morphology, and climate. Geology and morphology determine the favorable host environment and limiting capacity for the localization of uranium; climate is the main variance and the guide to the type of deposit formed. Climate determines the availability of moisture necessary to activate the release and transportation of uranium to the host area. Thus, deposits formed in wetland and tropical climates generally are smaller and less stable than those formed in arid climates. The mineralization in the former case is subject to constant depletion and redeposition at new locations. In essence, the limitations of wetland and tropical surficial deposits greatly reduce their economic potential.

Deposits classified as transitional may develop in any environment, maintaining many of the same characteristics listed above. One significant difference is the availability of uranium-charged waters making contact with abundant organic-rich sediments. The deposits are small and constitute a limited resource base. An average uranium content of 0.10 percent to 0.20 percent U_3O_8 would be significant; most occurrences average less. In certain deposits, uranium values are known to exceed 1.00 percent U_3O_8. The economic potential of these deposits is questionable due to a lack of understanding and no past history of mining. Exploitation of one deposit located in the state of Washington began in 1983; however, the project is presently on standby due to economic uncertainties in the uranium market.

Exploration Procedures

Exploration techniques for surficial uranium are not as well defined as those for other geologic settings. This is due to the unconventional nature of the occurrence. Explorationists are still learning about surficial deposits, especially those formed in Recent times. However, once the peculiarities of surficial uranium were identified, the development and application of new and modified prospecting techniques began to show success, primarily in the areas of geophysics and geochemistry.

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RAW MATERIALS

The basic exploration approach for surficial deposits includes geologic reconnaissance to identify potential uranium source rocks. Granitic intrusions and related rocks are indications of possible sources. In addition, a favorable geomorphic setting must be identified. In arid climates, large paleodrainage systems (fluviatial and playa environments) in close proximity to source rocks become ideal exploration targets. Both environments are readily identified by aerial photography and geophysical surveys (*Landsat imagery* is the latest exploration tool available.)

The airborne survey is followed by surface reconnaissance of identified target areas. A detailed sampling program of all rock types and surface water is necessary to determine the presence of uranium in the source rock and in any solutions migrating through the uranium source area to sediments in the paleodrainage system. A ground geophysical survey (resistivity and seismic are both effective techniques) helps outline channel configurations, establishing solution flow patterns. Geochemical studies further identify the presence of uranium and other minerals commonly associated with uranium (molybdenum, vanadium, copper, and selenium), enabling geologists to establish the depositional sequence and distribution of uranium.

Radiometric studies are a viable exploration tool for the older, stable deposits, but are ineffective for the young deposits exhibiting low radioactivity. Radiometric evaluation techniques have improved considerably in the past decade. Early scintillation instruments could not distinguish variations in radioactive emissions given off by unstable uranium mineralization, resulting in gross misinterpretation of total uranium resources available in certain deposits.

More recently, relatively accurate evaluation techniques have been developed which eliminate disequilibrium problems. Instrumentation is available which discriminates beta/gamma radiation given off by uranium, thorium, and potassium. The CaF/NaI detector is designed to count both emitters of radioactivity as a measurement of disequilibrium in a uranium sample.

Other instrumentation developed for quantitative analysis of radioactive material is referred to as Low Energy Gamma Spectrometry. This evaluation method measures low energy gamma emissions from the uranium and thorium decay series. Uranium and thorium values are recorded in parts per million; disequilibrium becomes a negligible factor. The instrument is easily adaptable to field use for rapid evaluation of surface samples and drill cuttings.

Radon gas detection methods also have practical application in arid environments. Radon gas is an alpha emitter. Information collected from alpha detectors is converted to radon intensity profile maps showing anomalous concentrations. Each anomaly represents a potential uranium resource area which can be further evaluated by drilling and trenching. Surficial uranium occurrences can be detected with accuracy, but disequilibrium factors of a deposit will affect final interpretation. A radon survey can be useful to outline channel configuration if the nature of mineralization is somewhat consistent.

The most reliable exploration procedure is drilling. The drill results will provide three-dimensional evidence of an ore deposit. Nevertheless, special drilling techniques may have to be adopted for best results due to variations in rock type and cementation, the conditions which control mineralization.

Reverse circulation drilling is probably the most common drilling method. This technique utilizes double-walled drill rods wherein compressed air or drilling fluids are forced down the annular space between the two rods. The drill cuttings are returned to the surface through the center rod. All material returned to the surface passes into a special collection device from which samples are taken for further study and chemical assay. Conventional diamond-core drilling and surface excavation work are often essential to support drilling results and to accumulate enough mineralized material for bulk testing and final metallurgical planning. It is a common practice to produce geophysical surveys for each drill hole in order to correlate both geology and mineralization throughout the extent of the deposit.

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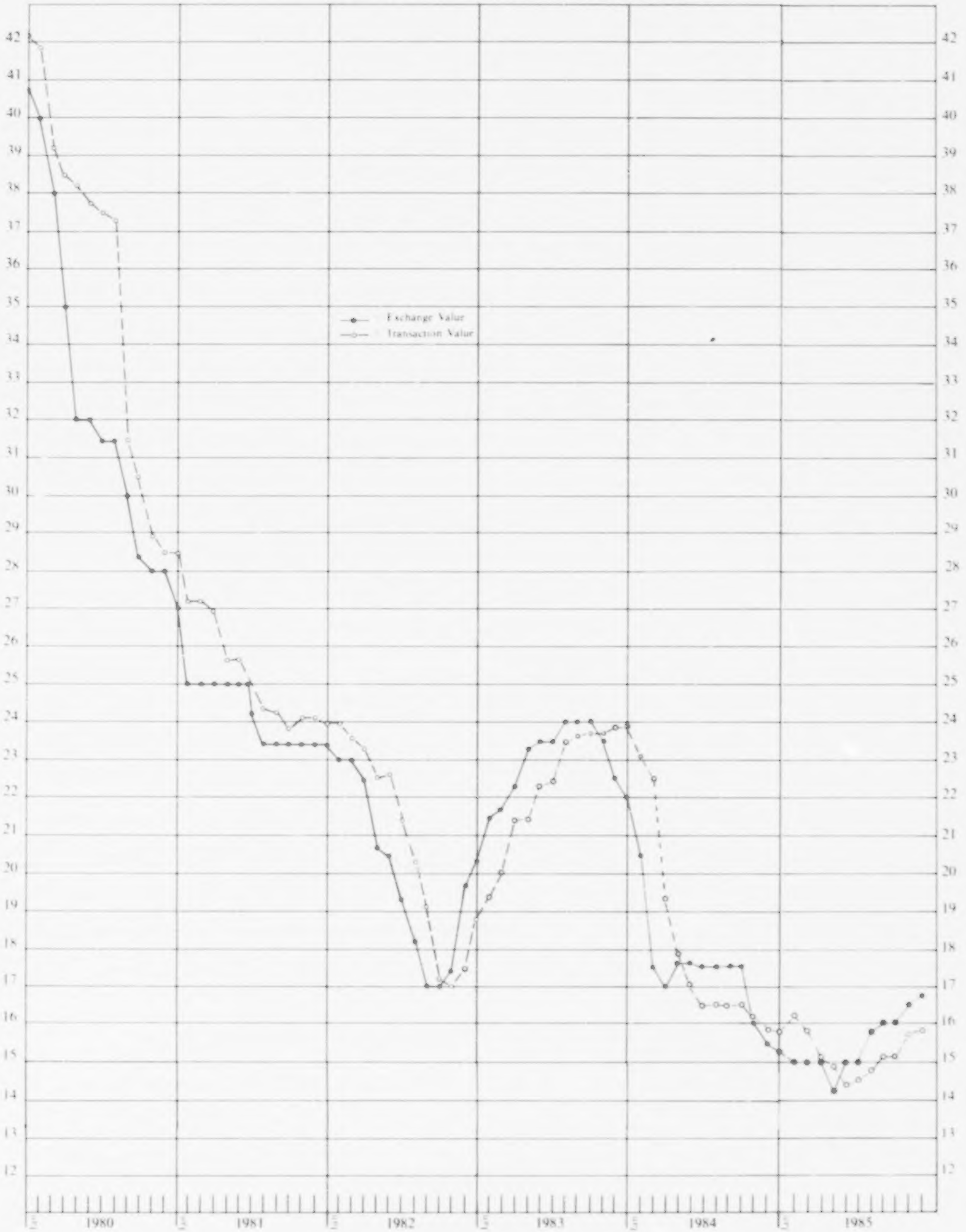
HISTORICAL MARKET DATA

EXCHANGE AND TRANSACTION VALUES
SINCE JANUARY 1980

Determined as of the last day of the month indicated



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HISTORICAL MARKET DATA

HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	32.50	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	**16.75**	

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	**15.80**	

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U as UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	**1.60**	

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AUSTRALIA

	Price Index of Materials Used in Manufacturing Industry—All Groups[1] (1969=100) (1976=100)	Award Rates of Pay Indexes Australia—Adult Males In Mining Wage and Salary Earners, Weekly Rates[2]
1975 Avg.	150.4	132.6
1976 Avg.	168.4	160.9
1977 Avg.	192.0	179.0
1978 Avg.[3] [4]	198.5	190.0
1979 Avg.	248.8	127.9
1980 Avg.	321.8	140.8
1981 Avg.	355.3	154.1
1982 Avg.[5]	368.6	174.9
1983 Avg.	401.2	181.8
Jan 1984	399.2	188.7
Feb 1984	402.5	188.6
Mar 1984	403.9	188.4
Apr 1984	404.2	196.2
May 1984	403.8	197.0
Jun 1984	404.9	197.4
Jul 1984	408.3	197.4
Aug 1984	413.2	197.4
Sep 1984	411.9	197.4
Oct 1984	408.5	197.4
Nov 1984	407.1	197.4
Dec 1984	406.0	197.4
FY84 Avg.[6]	402.1	—
FY85 Avg.[6]	422.2	—
Jan 1985	409.3	197.4
Feb 1985	416.1	197.4
Mar 1985	430.9	197.4
Apr 1985	440.8	202.3
May 1985	454.4	202.3
Jun 1985	458.9	202.4
Jul 1985	459.0	202.3
Aug 1985	454.9	202.4
Sep 1985	447.7	202.4

P = Preliminary R = Revised since last month

[1] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0).

[2] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

[3] Monthly data for 1970-78 appear on pages 4.7 and 4.8 of Report 138.

[4] Annual averages prior to 1979 reflect index base no longer in use.

[5] Monthly data for 1979-82 appear on page 35 of Report 184.

[6] Annual averages are for financial year ending June 30.

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GOVERNMENT STATISTICS

CANADA

	Industry Selling Price Index: Manufacturing[1] (1971=100)	Wage-earner Data: Average Hourly Earnings (C$)[2] Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells[3] (SIC 051-099)	Primary Metal Industries Non-ferrous[4] (SIC 296)	Primary Metal Industries Non-ferrous[4] (SIC 298)	Chemicals and Chemical Products[5] (SIC 372-379)
1979 Avg.[6]	217.9	—	9.60	9.66	—	—	7.67
1980 Avg.	247.2	—	10.58	10.80	—	—	8.50
1981 Avg.	288.7	—	12.02	12.23	—	—	9.53
1982 Avg.[7]	288.8	—	13.74	13.92	—	—	10.63
1983 Avg.	298.8	—	—	14.30	—	—	11.17
Jan 1984	305.4	17.74	15.27	14.74	11.91	10.84	11.69
Feb 1984	306.6	17.90	15.59	14.90	12.04	10.82	11.51
Mar 1984	308.7	18.05	15.52	14.82	12.14	10.84	11.58
Apr 1984	310.5	18.06	15.83	15.10	11.96	10.34	11.63
May 1984	310.6	18.48	15.64	15.06	12.11	10.16	11.65
Jun 1984	311.0	18.08	15.48	14.80	12.38	10.40	11.66
Jul 1984	312.9	17.81	15.72	14.92	12.53	10.18	11.82
Aug 1984	312.7	17.24	15.36	14.92	12.44	10.34	11.78
Sep 1984	312.3	17.68	15.96	15.34	12.51	10.52	11.90
Oct 1984	312.3	17.64	16.15	15.26	12.69	10.56	11.96
Nov 1984	313.6	18.04	16.13	15.43	12.47	10.51	11.96
Dec 1984	314.2	17.95	16.39	15.60	12.16	10.40	11.99
1984 Avg.	310.9	17.88	—	15.07	12.28	10.49	11.76
Jan 1985	315.9	18.05	16.13	15.60	12.32	10.80	12.04
Feb 1985	316.5	18.78	16.41	15.68	12.52	11.05	12.06
Mar 1985	318.0	18.24	16.21	15.57	12.44	10.97	12.02
Apr 1985	318.3	18.63	16.44	15.80	12.81	11.23	12.04
May 1985	318.8	19.41	16.51	15.63	12.76	11.25	12.15
Jun 1985	319.1R	18.49	16.20	15.49	12.89	11.14	12.14
Jul 1985	319.4R	18.14	16.19R	15.41R	12.96	11.17	12.13
Aug 1985	319.2R	17.07R	15.76R	15.30R	12.97R	11.31R	12.19R
Sep 1985	319.4R	17.92P	16.16P	15.61P	12.94P	11.38P	12.40P
Oct 1985	320.2P	—	—	—	—	—	—

P = Preliminary R = Revised since last month

[1] Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision.

[2] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours" (Catalogue 72-002).

[3] Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

[4] Beginning with the April 1983 figure, Primary Metal Industries, non-ferrous is split into SIC 296 and SIC 298.

[5] Chemical and Chemical Products prior to April 1983 was SIC 370-379. The new series is from a new survey which includes all companies and is based on a 1970 classification. The old survey only included companies of 20 employees or more.

[6] Monthly ISPI for 1977 and 1978 appear on page 4.10 of Report 138, and monthly wage-earner data for 1973-78 appear on page 4.11 of Report 138.

[7] Monthly data for 1979-1982 appear on page 37 of Report 184. On that page, the wage earner index entitled "Metal Mining, Including Milling (SIC 050-099)" should read "Total Mining (SIC 051-099)."

[8] Beginning with the April 1983 figure, Wage Earner Data are based on a census of all companies employing 200 or more wage earners, *plus* a random survey of companies employing fewer than 200 wage earners. Prior to April 1983 only companies employing 200 or more wage earners are included in the Wage Earner Data.

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REPUBLIC OF SOUTH AFRICA

	Average Declared Working Costs per per Metric Ton of Gold Ore Milled (Rand)[1]	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982=100)[2]	Consumer Price Index[3] (1980=100)[4]	Producer Price Index All Groups[5] (1980=100)	Total Employment in Mining and Quarrying (Code 35)[6]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[6]
1975 Avg.	16.71	—	157.2	100.0	639,473	1,003,617
1976 Avg.	19.30	—	174.7	115.1	671,240	1,212,983
1977 Avg.	23.87	—	194.4	130.0	712,006	1,420,670
1978 Avg.	27.14	—	137.2	142.7	664,571	1,537,169
1979 Avg.[7]	30.18	—	155.3	164.5	692,209	1,830,632
1980 Avg.[8]	35.53	—	176.7	192.1	714,379	2,279,615
1981 Avg.	41.89	—	206.5	218.3	728,506	2,820,505
1982 Avg.[9]	47.25	104.2	233.5	248.7	707,552	3,246,071
1983 Avg.	51.87	115.0	262.2	274.8	696,579	3,644,772
Jan 1984	—	—	274.7	283.3	689,807	326,619
Feb 1984	—	—	278.4	286.5	702,553	335,906
Mar 1984	55.30	123.1	281.9	288.0	715,628	342,332
Apr 1984	—	—	286.1	290.2	712,963	327,550
May 1984	—	—	288.3	292.6	710,040	327,937
Jun 1984	56.95	126.2	291.2	295.3	717,009	347,121
Jul 1984	—	—	295.1	296.0	717,121	369,964
Aug 1984	—	—	297.0	300.8	721,905	361,357
Sep 1984	60.64	133.2	299.9	304.1	721,470	359,218
Oct 1984	—	—	303.7	308.7	717,865	363,755
Nov 1984	—	—	307.4	312.8	717,396	369,771
Dec 1984	62.92	138.6	309.4	315.9	701,198	365,234
Jan 1985	—	—	177.1	166.6	711,366	376,777
Feb 1985	—	—	182.8	171.3	727,932	361,823
Mar 1985	64.48	142.4	183.6	173.0	708,809	371,380
Apr 1985	—	—	187.4	174.0	724,187	369,005
May 1985	—	—	189.5	177.7	708,085	373,478
Jun 1985	67.42	148.9	191.9	179.2	724,587	395,543
Jul 1985	—	—	193.6	180.7	738,228	419,106
Aug 1985	—	—	195.6	183.2	734,121	416,777
Sep 1985	70.47	155.3	197.8	184.8	—	—
Oct 1985	—	—	200.8	—	—	—

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[1] Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly.

[2] Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

[3] Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."

[4] The basis for calculation prior to January 1985, 1975 = 100. For annual averages prior to 1978, April 1970 = 100.

[5] Previously known as the Wholesale Price Index, now the Producer Price Index. The computation remains the same. The basis for calculation prior to January 1985, 1975 = 100.

[6] Bulletin of Statistics, Department of Statistics, Pretoria.

[7] Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 4.9 of Report 140.

[8] Monthly data for Codes 35 and 40, 1977-1980, appear on page 28 of Report 157.

[9] Monthly data for 1979-82 appear on page 39 of Report 184.

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UNITED STATES

	Producer Price Index[1]		Consumer Price Index[2] (1967=100)	GNP Implicit Price Deflator[3] (1972=100)	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4]			
	Industrial Commodities (1967=100)	All Commodities (1967=100)			Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1975 Avg.	171.5	174.9	161.2	125.79	6.13	6.24	5.39	4.64
1976 Avg.	182.4	183.0	170.5	132.34	6.76	6.87	5.91	4.96
1977 Avg.	195.1	194.2	181.5	140.05	7.28	7.67	6.43	5.39
1978 Avg.[5]	209.4	209.3	195.4	150.42	8.23	8.56	7.02	5.82
1979 Avg.	236.5	235.6	217.4	163.42	9.27	9.50	7.60	6.32
1980 Avg.	274.8	268.8	246.8	178.64	10.26	10.63	8.30	6.94
1981 Avg.	304.1	293.4	272.4	195.51	11.55	11.98	9.12	7.62
1982 Avg.[6]	312.3	299.3	289.1	207.15	12.33	12.94	9.96	8.21
1983 Avg.	315.8	303.1	298.4	215.63	12.57	13.43	10.59	8.65
Jan 1984	319.1	308.0	305.2	—	12.68	13.37	10.88	8.91
Feb 1984	320.6	308.9	306.6	—	12.83	13.33	10.87	8.91
Mar 1984	321.9	311.0	307.3	220.58	12.89	13.32	10.96	8.94
Apr 1984	322.5	311.4	308.8	—	12.94	13.29	10.94	8.94
May 1984	323.3	311.7	309.7	—	13.02	13.36	11.99	8.94
Jun 1984	323.9	311.4	310.7	222.40	12.99	13.39	11.00	8.97
Jul 1984	324.0	312.0	311.7	—	13.06	13.34	11.09	9.00
Aug 1984	323.5	310.9	313.0	—	13.15	13.50	11.09	9.05
Sep 1984	322.3	309.5	314.5	224.57	13.23	13.38	11.20	9.13
Oct 1984	323.2	309.4	315.3	—	13.26	13.53	11.29	9.15
Nov 1984	323.8	310.4	315.3	—	13.27	13.74	11.31	9.20
Dec 1984	323.0	309.9	315.5	226.10	13.32	13.64	11.34	9.32
1984 Avg.	322.6	310.3	311.1	223.43	13.05	13.43	11.08	9.04
Jan 1985	322.9	309.5	316.1	—	13.29	13.70	11.39	9.33
Feb 1985	322.5	309.2	317.4	—	13.30	13.73	11.39	9.33
Mar 1985	322.6	308.7	318.8	229.07	13.29	13.95	11.37	9.39
Apr 1985	323.8	309.3	320.1	—	13.43	13.62	11.48	9.40
May 1985	325.3	309.8R	321.3	—	13.24	13.59	11.46	9.39
Jun 1985	324.8R	309.2R	322.3	230.55R	13.23	13.66	11.52	9.46
Jul 1985	324.3	309.0	322.8	—	13.45	13.82	11.60	9.47
Aug 1985	323.6	307.2	323.5	—	13.55R	13.69R	11.62R	9.50R
Sep 1985	322.5	305.8	324.5	231.85R	13.45	13.66	11.66R	9.56R
Oct 1985	324.4	308.0	325.5	—	—	—	11.72	9.56

P = Preliminary R = Revised since last month

[1] US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

[2] US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items.

[3] US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

[4] US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." 2. All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for 1977-1978 are adjusted to the March 1979 benchmark. Data for January 1979 and beyond are adjusted to the March 1980 benchmark.

[5] Monthly data 1970-1978 for Producer Price Index-Industrial Commodities, Consumer Price Index, and Employment and Earnings SIC codes 10, 333, and 28, and quarterly data for GNP Implicit Price Deflator appear on pages 4.6-4.8 of Report 139.

Monthly data 1977-1978 for Employment and Earnings SIC Codes 10, 333, and 28 appear on page 33 of Report 147.

Monthly data 1970-1978 for Employment and Earnings SIC Code 36 appear on page 23 of Report 154.

Monthly data 1977-1980 for Producer Price Index-All Commodities, appear on page 21 of Nuexco Report 158.

[6] Monthly data 1979-1982 for all listed indices appear on page 41 of Report 184.

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REPRESENTATIVES AND CONSULTANTS

AUSTRALIA

Peter Stork
Oratom Consulting*
5 Gould Ave.
St. Ives
NSW 2075, Australia
Telephone: (61-2) 449-6783
Telex: 23976 (COMTLX)

JAPAN

Kazy Yokota
Japan Tech Services*
Ohkura Building (3F)
1-4-10 Shiba Daimon
Minato-ku, Tokyo, Japan
Telephone: (81-3) 431-6031, 6025
Telecopy: (81-3) 434-6674
Telex: 242-5060 (JATECH J)

SOUTH AFRICA

Chris I. Von Christierson
Southern Prospecting (Pty) Limited*
P.O. Box 61409
Marshalltown 2107
Republic of South Africa
Street Address:
10th Floor
Eagle Star House
70 Fox Street
Johannesburg 2001
Telephone: (27-11) 838-1868
(27-11) 834-4211
Telex: 4-89878 SA

TAIWAN

Edward Bee
Bee & Liang Company, Ltd.*
14 FL Universal Business Center
NO. 663, Tun Hwa South Road
P.O. Box 1396
Taipei, Taiwan R.O.C.
Telephone: (886-2) 704-9630
TWX: 785-11570 (BEELIANG)

UNITED STATES

Harold C. Lindberg*
83-A Hardee Lane
Whispering Pines, N.C. 28327
Telephone: (919) 949-3622

Ralph O. Smith*
141 Braemar Drive
Cheshire, Connecticut 06410
Telephone: (203) 272-6246

SPECIAL CONSULTANTS

James C. C. Stewart
U.K. Nuclear Industry

Claus C. Thiesen
Japan Nuclear Industry

W. Bryan Webster
International Business Development

J. Robert Wolcott
International Business Development

*Independent contractors representing Nuexco

NUEXCO

EXECUTIVE SUMMARY
REPORT 208
(All data as of November 30, 1985)

Exchange Value **$16.75, up $0.25**	The **Exchange Value** is **$16.75** per pound U_3O_8, up $0.25 since last month.
UF_6 Value **$46.00, unchanged**	The **UF_6 Value** is **$46.00** per kilogram U as UF_6, unchanged since last month.
Transactions	One recent natural uranium sale is reported, involving approximately 100 to 300 thousand pounds U_3O_8 equivalent. The sale involved spot or near-term delivery and also met the conditions for inclusion in the Transaction Value.
Supply-Demand Ratio **fell to 1.6:1**	Active spot and near-term **uranium supply** amounts to **3.6 million** pounds U_3O_8 equivalent, up 405 thousand pounds since last month. Active spot and near-term **uranium demand** totals **2.3 million** pounds, up 1.4 million pounds. The spot and near-term **supply-demand ratio** fell to **1.6:1.**
Transaction Value **$15.80, up $0.05**	The **Transaction Value** is **$15.80** per pound U_3O_8, up $0.05 since last month. The calculation includes 14 transactions involving a total of 2.5 million pounds U_3O_8 and equivalent UF_6, and covers a period of 5 months.
Loan Use Charge Rate **unchanged at 5%**	The **Loan Use Charge Rate** is **5 percent** per annum, unchanged.
Conversion Value **unchanged at $1.60**	The **Conversion Value** is **$1.60** per pound U as UF_6, unchanged since last month in a dormant market. No active secondary market supply or demand for conversion services for delivery within three years is reported.
SWU Values **for 1986 delivery:** **$78 for DOE origin** **$78 for non-DOE origin**	The **SWU Value** for DOE origin at .3 tails and certifiable as excess, is **$78** per SWU for delivery by the end of FY86. The SWU Value for other SWUs (non-DOE or non-certifiable) is **$78** per SWU for delivery by the end of calendar year 1986. One secondary market SWU transaction, involving less than 50 thousand DOE-origin SWUs, is reported.

* * *

Focus	**Belgium** recently completed the plant-construction phase of its nuclear power program as Doel Unit 4 and Tihange Unit 3 reached full-power operation in June and July of 1985. Currently, there are no plans for additional units in Belgium, but the nation's utilities and industrial groups are participating in various European nuclear energy projects.
Australia	The Olympic Dam partners soon will decide on whether to commit to the project despite the reported lack of firm delivery commitments.
Raw Materials	The worldwide search for uranium has resulted in the discovery and recognition of many unconventional types of uranium occurrence. Part One of a two-part article describes various classifications and sources of surficial uranium deposits, and examines some of the exploration techniques used to locate those deposits.

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NUEXCO REPORT 208 FIGURES OF THE MONTH (November 30, 1985)	This Month (Report 208)	Last Month (Report 207)	12 Months Ago (Report 196)
Exchange Value[1]	16.75	16.50	15.50
Transaction Value[1]	15.80	15.75	15.90
UF_6 Value[2]	46.00	46.00	—
Loan Use Charge Rate[3]	5%	5%	6%
Conversion Value[4]	1.60	1.60	0.80
Near-Term Uranium Supply[5]	3.6	3.2	5.2
Near-Term Uranium Demand[6]	2.3	0.9	1.3
Near-Term Supply-Demand Ratio	1.6	3.6	4.0
Recent Uranium Sales:			
Number of Transactions[7]	1	5	3
Quantity of Material[8]	0.2	1.4	9.8
Nuexco SWU Values:[9]			
DOE origin, certifiable as excess, 0.3 tails assay, delivery before the end of FY86	78	83	—
Other SWUs (non-DOE or non-certifiable), delivery by the end of calendar year 1986	78	83	—
USDOE SWU Prices:			
USEC	125.00[10]	125.00[10]	135.00
AFC	153.00[11]	153.00[11]	153.00[11]
Requirements	157.00[11]	157.00[11]	157.00[11]
Market Value of Enriched UF_6[12,13]:			
2.5 w/o U_{235}	451	460	518
3.0 w/o U_{235}	578	591	671
3.5 w/o U_{235}	707	723	828
4.0 w/o U_{235}	837	858	987

---

[1] US $ per pound U_3O_8 equivalent.

[2] US $ per kilogram U as UF_6.

[3] Per annum.

[4] US $ per pound U as UF_6.

[5] Active inquiries to sell, for delivery within 12 months after contract signing (millions of pounds U_3O_8).

[6] Active inquiries to purchase, for delivery within 12 months after contract signing (millions of pounds U_3O_8).

[7] Uranium sales only; does not include loans, conversion, or SWU transactions.

[8] Millions of pounds U_3O_8, equivalent.

[9] US $ per SWU.

[10] Effective 10/1/85.

[11] Effective 10/1/84.

[12] Calculated using the Nuexco Exchange Value, Conversion Value, and 0.30 percent tails assay. As of 4/30/85, calculations use the Nuexco SWU Value for DOE origin and delivery by the end of FY86.

[13] US $ per KgU as UF_6, rounded to the nearest $.

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The following is a slightly edited version of a speech presented by George White, Jr. at the Atomic Industrial Forum's Annual Conference in San Francisco, California on November 11, 1985.

Introduction

Some very fundamental changes have occurred in the uranium market. I believe there is persuasive evidence to suggest that uranium prices are unlikely to rise to a level that will allow, in a free market environment, a rebirth of the US uranium production industry. More specifically, I do not expect to see uranium prices reach a level that will allow the US industry to produce more than 30 to 35 percent of US requirements. In addition, since it is almost certain that some portion of US production will always be exported, US utilities will likely obtain more than two-thirds of their long-term needs from non-US sources. In other words, the US uranium industry is unlikely to produce as much as 13 million pounds of U_3O_8 annually at any time in the foreseeable future.

It is inconceivable to me that, given current market data and unencumbered by a knowledge of the industry's history, a fresh observer of the uranium scene could postulate:

- a US industry that would produce 40 million pounds of U_3O_8 annually, or
- a US import embargo, or
- spot market prices of $40 per pound U_3O_8.

There are a number of factors which, in combination, lead me inexorably to the conclusion that these conditions will not occur. In no particular order of importance, they include:

1. A greatly expanded resource base characterized most recently by very high-grade and, presumably, low-cost finds.
2. A cumulative world inventory that has continued to grow, despite static or declining world production.
3. A competitive market for enrichment services that has negative implications for uranium demand.
4. Current and prospective technology developments that reduce uranium demand, including improved fuel design, increased recycling, and, perhaps most important, laser enrichment.
5. Finally, there is enhanced utility awareness and sophistication about the realities of capacity factors, supply, demand, and security of supply.

Each of these items suggests either decreased uranium demand, deferral of uranium demand, increased uranium supply, or lower-cost uranium supply. Taken together, they argue against higher prices and, by inference, against a rebirth of a US production industry.

Resources

The expanded resource base is the result of the exploration boom that was triggered by the sharp price increases in the mid-to-late 1970s. Earlier concerns about the lack of sufficient uranium to fuel the multitudes of reactors on order have given way to recognition that this planet has more uranium than we are ever likely to need in our lifetimes, and price is the real issue. The province of Saskatchewan presents a multitude of deposits. Key Lake, Cluff Lake, Dawn Lake, and Cigar Lake are well-known names. Close Lake, with its indication of grades similar to those at Cigar Lake, is perhaps less well-known. Though not a geologist, I conclude that we have seen only the tip of the Saskatchewan uranium iceberg. Or, consider Australia, where the Jabiluka deposit, with more than 500 million pounds U_3O_8 proved, is effectively shut in by government policy. Or, consider ERA, which has announced plans to increase production from 6 million to 12 million pounds U_3O_8 annually. Or, consider the United States, which only five years ago produced more than 43 million pounds. There can be no doubt about the existence of adequate uranium resources. On the contrary, there is a surfeit. Furthermore, recent experience suggests there is every likelihood that further exploration efforts will lead to further high-grade finds.

Given the existing resource base, the propensity of miners to produce what they discover, the inclination of consumers to encourage such production, and given that uranium demand is essentially inelastic, there is a very powerful and natural impetus to put projects into production. At times, there are also political or economic driving forces.

In Australia, the huge Olympic Dam project is reportedly going forward in the face of difficult markets for its copper and uranium and a mediocre market for its gold. Production targets have been downsized from initial plans, but it will produce nonetheless. In Niger, where uranium provides nearly 75 percent of that country's foreign exchange, it can be anticipated that substantial cutbacks in uranium production would face strong opposition. Moreover, Canada has emerged as the world's largest producer based on its rich Saskatchewan deposits. There can be little doubt that Canada has the will and the means to protect and expand its market share.

Inventory

Nuexco estimates that cumulative world inventory will approach 500 million pounds U_3O_8 equivalent by year-

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end 1985. This is sufficient to fuel all reactors through the end of 1990 if not a single additional pound were produced after today. Even during 1985, after five years of price decline, estimated production of about 95 million pounds U_3O_8 will exceed estimated consumption by some 5 to 10 million pounds. Of that 500 million pounds total inventory, more than 200 million is judged to be excess—in the sense that it is above desired inventory levels. As such, its inevitable impact on the market will occur in one of two ways. If held by a utility, and not sold, the inventory will delay the date when that utility needs new supplies. Alternatively, if the inventory is liquidated into the spot market, its sale will fulfill some end-user's needs, deferring that end-user's needs for new supply from primary sources.

While the uranium market has historically been inefficient with respect to the redistribution of excess inventory, the experience of the past two years suggests increased inventory mobility and enhanced market efficiency. The primary effect of rectifying the maldistribution of existing inventory is the deferral of need to purchase new supply from primary sources. Fewer buyers needing less material naturally results in intensified competition among sellers for those fewer, smaller, and deferred opportunities that do become available. Such competition leads to lower prices.

Enrichment

The uranium market is linked closely to that for enrichment services. In fact, from the early 1970s through 1983, the primary driving force underlying uranium demand was the requirement to delivery uranium to DOE to fulfill enrichment contract obligations. Not surprisingly, the uranium demand generated by these enrichment contracts was substantially in excess of and occurred earlier than real needs based on actual reactor consumption of uranium. Utilities were placed in the unusual position of purchasing uranium not to meet reactor needs, but to avoid the severely high financial penalties associated with failure to meet their enrichment obligations with DOE. This situation reached its zenith in the case of utilities taking and paying for uranium to deliver to DOE for enrichment even *after* their nuclear plants had been canceled.

Such a situation could not endure for long. The monopolistic US enrichment enterprise fostered competition in the form of a secondary market and two European enrichers, Urenco and Eurodif. As enrichment prices fell and the US dollar strengthened, DOE saw its market share and revenue stream erode. Finally, DOE adopted a market-driven and competitive business strategy, the centerpiece of which was its new requirements-type contract. While this strategy has reestablished DOE as a viable player in the enrichment market, it raised havoc with the uranium industry. After 10 years of being driven by an artificial stimulus, uranium demand again became primarily a function of reactor consumption. Today, as the market readjusts itself based on real needs, uranium producers are feeling the full effect of the excesses engendered by DOE's earlier enrichment policy.

Furthermore, the relationship between uranium and enrichment prices is such that as SWU prices are driven lower in a competitive market, increases in uranium prices will tend to be restrained since utilities can use less uranium and more SWU.

Technology

Several developments in the area of technology point to reduced uranium requirements. Full reprocessing and recycle of uranium and plutonium could eventually reduce uranium requirements by as much as 30 percent. Today in the USA there are no reprocessing facilities in operation, nor are any likely to operate in the foreseeable future. However, reprocessing and recycle *are* proceeding in both Japan and Europe and will reduce the demand for natural feed in the years ahead. It should be noted, however, that such changes will be gradual and would be reflected not as visible reductions in demand, but rather as slower growth in demand.

In the area of fuel design, certain improvements, such as higher exposure, tend to decrease uranium needs. Other improvements, such as longer fuel cycles, can result in increased uranium needs. On balance, however, expected fuel improvements will likely lead to a net reduction in uranium consumption, perhaps as much as 5 percent, from the level forecast without such improvements.

A more important technology-related issue is that of the laser enrichment process. This process has been chosen by DOE as the next step in the US enrichment program. It holds the potential for dramatic reductions in enrichment prices. As one uses more SWU, less uranium is needed, and vice versa. Obviously, as the price of SWU declines, economics will dictate the use of more SWU and less uranium. Thus, cheap SWU represent a very real threat to uranium suppliers. Going a step further, it has been reported that the laser enrichment is economic using depleted uranium as feed. If so, I suggest that DOE's existing stockpile of tails represents one of the world's largest uranium mines. I further suggest that it is not out of the question to visualize that instead of selling only SWU, DOE could one day sell enriched product, using its

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inventory of tails as a source of uranium. This is speculative, but may not be that unrealistic, assuming AVLIS works as advertised. Furthermore, both the French and Japanese are also pursuing laser technology.

Customer Attitudes

Finally, there is the utility, the ultimate end-user. I suggest that, in recent years, the utilities have greatly increased their level of market sophistication. In the early 1970s, few utilities really understood the dynamics of the uranium market. However, antitrust suits, the Grand Jury investigation, the Westinghouse default, the roller-coaster price movements of all fuels, the increased attention of public utility commissions, and expanded sources of market information have all combined to lead to an increased awareness and market sophistication.

Early concerns about running out of uranium have faded with recognition of the real size of the resource base, and the knowledge that for the past 30 years, more uranium has been produced than consumed in each and every year. Similarly, uranium commerce is no longer the great mystery it once was. Uranium mining, conversion, enrichment, and fabrication are well understood, as are such associated factors as transportation, insurance, and specifications. Location, nationality and tails-assay swaps, uranium loans, deconversion, deenrichment, and even defabrication transactions are commonplace. And, after hundreds of reactor years of experience, utilities know that nuclear plants usually don't start as early as anticipated and recognize that capacity factors of 95 percent are not the norm.

As a consequence, utility views about the necessity of large inventories to protect against unanticipated events have moderated, as have their concerns about the likelihood or consequences of interruptions of supply. Inventory accumulation based on favorable spot prices will continue, but as prices rise, such accumulation will naturally decline. Inventory accumulation for security of supply purposes will be less of a factor.

Price Implications

Consultants in every industry make price forecasts. The uranium industry is no exception, and a number of long-term forecasts have received media attention. These forecasts, stated in 1985 dollars, have been in the general range of $30 to $40 per pound U_3O_8. It is my personal view that such forecasts are too high. As noted, I believe fundamental, structural changes are in process in the uranium market, and that these changes will alter the market in the longer term. I conclude, therefore, that these forecasts may be as much as 20 to 30 percent too high.

I must emphasize that my comments assume a free market environment. If the base scenario is altered by a shutoff of uranium supply as a consequence of revolution in Southern Africa, or by cartel-mandated floor prices, or by a US embargo on foreign-origin uranium, the conclusions would have to be reexamined. However, for a number of political and economic reasons I do not believe than any of these events is likely. With respect to the issue of the viability of the US uranium industry, DOE has made official what most of us have known for some time the US uranium production industry is not viable if viability is defined as the ability to economically produce and sell sufficient quantities of uranium to supply the major part of US utility needs. Notwithstanding the laws as written, the current court case, and calls for legislation to protect the US industry, I do not anticipate that the US government will take any meaningful action in that direction.

Nevertheless, a US uranium production industry will survive. The survivors will include in-situ and by-product producers and those conventional producers with higher-grade ore and rigorous cost control. In part, their survival will also reflect the desire of most US utilities to have at least some portion of their uranium supply be of US origin.

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MONTHLY REPORT

ON THE NUCLEAR FUEL MARKET

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HEADQUARTERS

Three Park Central
1515 Arapahoe Street
Suite 1045
Denver, Colorado 80202
Telephone. (303) 893-4015
Telecopy: (303) 825-4821
Telex: 450202 (NUEXCO DVR)

Managing Director
Oren L. Benton

NORTHEAST UNITED STATES

100 Prospect Street
Century Plaza South
Stamford, Connecticut 06901
Telephone: (203) 323-1999
Telecopy: (203) 325-1483
Telex: 4750124 (NUEXCO C)

Managing Broker
Earl E. Hoellen, Jr.

SOUTHEAST UNITED STATES

Suite 905
Ten Piedmont Center
Atlanta, Georgia 30305
Telephone: (404) 262-7375
Telecopy: (404) 233-6210
Telex: 4611142 (NUEX ATL)

Managing Broker
M. Jerry Reaves

WESTERN UNITED STATES

Building 3, Suite 290
3000 Sand Hill Road
Menlo Park, California 94025
Telephone: (415) 854-1510
Telecopy: (415) 854-2115
Telex: 470674 (NUEXCO UI)

Managing Broker
George White, Jr.

EUROPE

13 chemin du Levant
01210 Ferney-Voltaire
France
Telephone: (33-50) 428035
Telecopy: (33-50) 428526
Telex: 385288 (NUEXCO F)

Managing Broker
James E. Vaughan

REGIONAL MANAGING BROKERS

AFRICA
James E. Vaughan

AUSTRALIA
George White, Jr.

CANADA
Wayne D. Fowler

EUROPE
James E. Vaughan

FAR EAST
Christian C. Guitton

(See inside back cover for list of Representatives and Consultants)

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MONTHLY REPORT ON THE NUCLEAR FUEL MARKET

January 1986 No. 209

GEORGE WHITE, JR., *EDITOR* CLARK M. BEYER, *ASSOCIATE EDITOR*

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NATURAL URANIUM AND SECONDARY MARKET CONVERSION

(All data as of December 31, 1985)

The **Exchange Value** is **$17.00** per pound U_3O_8, up $0.25 since last month. **Active supply** of natural uranium (concentrates and UF_6) for spot or near-term delivery totals **3,595,000** pounds U_3O_8 equivalent, down 20,000 pounds since last month. The corresponding figure for **active demand** is **2,325,000** pounds, up 55,000 pounds. The spot and near-term **supply-demand ratio** fell to **1.5:1.**

The *Current Market Data* section of this Report lists seven natural uranium sales, involving approximately 900,000 pounds U_3O_8. All of the transactions involved near-term delivery and also met the criteria for inclusion in the current Transaction Value calculation.

The **Transaction Value** is **$16.55** per pound U_3O_8, up $0.75 since last month. The considerable rise is due to the large number of December transactions (at prevailing prices) meeting the requirements for inclusion in the calculation.

The **UF_6 Value** is **$47.00** per kilogram U in UF_6, up $1.00 since last month.

The **Conversion Value** is **$1.60** per pound U in UF_6, unchanged since last month. Active supply of secondary market conversion services for delivery within three years totals 300 thousand pounds U as UF_6. No active demand and no secondary market conversion transactions are reported.

The **Loan Rate** is unchanged at **5 percent** per annum.

* * *

The Exchange Value continued its gradual rise as several utilities made purchases, effectively clearing much of the lower-priced material from the market. Traders played an active role in this month's transactions, selling material to utilities in Europe and the USA mostly at bargain levels. A number of utilities have entered the long-term market, and their purchasing decisions in the coming months could have a significant impact on the long-term price structure and, through feedback, on spot market prices. Many sellers are willing to offer above the $17.00 level, but if prices are to continue to move upward, demand must be sustained and sudden large inventory liquidations avoided. Demand has moved closer to supply over the past several months, but has not yet exceeded it.

The UF_6 Value also rose this month. As offering prices for uranium concentrates rise, sellers of UF_6 in turn expect higher prices in that thin market.

The continued decline of the US dollar relative to most other currencies resulted in a net decline in the effective Exchange Value for three uranium-consuming countries — Belgium, France, and the Federal Republic of Germany. The slight rise in the Exchange Value (expressed in US dollars) did not overcome the dollar's decline in those countries' currencies, again discouraging non-US sellers of spot or near-term material.

* * *

DOE and the US uranium producer group at year's end were still attempting to negotiate a settlement of the federal court lawsuit. As previously noted, the issues are such that none of the competing interests will be completely satisfied with an eventual resolution. DOE believes that any limitation on the enrichment of non-US origin uranium for domestic use would adversely affect its enrichment enterprise, fearing that US utilities, seeking the lowest cost of enriched product, might be motivated to abandon DOE in favor of non-US enrichment to utilize with available supplies of lower-priced, non-US uranium. Indeed, this month there were even reports that SWU from the USSR might be offered in the US in the near future.

Most of DOE's customers, both in the US and abroad, are perplexed as to how such a situation was allowed to come about. From a business point of view, there is a sense that while DOE devised an attractive enrichment contract, it did so for the wrong reasons and at the worst possible time. The reasoning behind and need for DOE's dramatic pricing initiatives were suspect from the outset, particularly in view of two anticipated factors:

1. The decline of the US dollar against foreign currencies;
2. The evaporation of the secondary market for enrichment services.

While outwardly opposing any embargo and exhibiting little sympathy for the US producers, many US utilities, unhappy that the validity of the US enrichment contract has been brought into question by the producers' lawsuit, would likely accept some type of limited embargo as the price of removing the uncertainty surrounding the contract. The governments of Canada, Australia, and other uranium-producing countries naturally have made it quite clear to the US government that they would view an embargo as a most unwelcome event. Shrinking the demand available to existing and prospective non-US producers would create additional downward price pressures as these producers competed for a share in a reduced market. The imposition of such an embargo could also invite retaliatory actions from those countries for which uranium is an important source of foreign exchange.

Even the US producers do not appear to be of a single mind on this issue. Some, already committed to withdrawing from the uranium business, seem primarily interested in mills tailings legislation. They largely support the embargo solely as a means to increase prices and property values, enabling them to dispose of their uranium-related assets and associated tailings liabilities.

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Others are committed to staying in the business and view an embargo, and the expected higher prices, as essential to their survival. However, it is doubtful that anything other than an immediate, high percentage (75 to 100 percent of non-US uranium) embargo would have the desired effects in the near-term. Prices appear to have bottomed, and a slow recovery underway for eight months continues. Nevertheless, buyers appear unconcerned, hard demand for near-term delivery is slight, and most of the recent upward price movement was a consequence of discretionary buying. In the past, this type of buying tended to evaporate as prices strengthened, usually followed by a new round of inventory selling and a new price cycle. Large blocks of excess inventory remain, and recently have become the subject of considerable attention by public utility commissions. This situation in turn could presage new liquidations. Only a high-percentage embargo, possibly with strict grandfather provisions, is likely to have sufficient shock value to alter existing perceptions.

* * *

ENRICHED URANIUM AND SWUS

The **SWU Value** as of December 31, 1985, is $80 per SWU. This refers to SWU at a tails assay of 0.30 weight-percent U_{235} and for delivery within one year. One secondary market SWU transaction is reported this month, involving 50 to 100 thousand SWUs of DOE origin.

The DOE-certifiable and non-DOE or non-certifiable SWU Values were merged this month as the sole remaining buyer restricted to purchasing DOE-certifiable SWU filled its requirement. Following that utility's purchase, sellers of certifiable SWU must now compete with sellers of non-DOE SWU for buyers without origin restrictions. Thus, the revised indicator measures the secondary market for SWU available for delivery within one year regardless of origin.

The small price increase reported this month (an increase of $2 over last month's $78 per SWU value for either origin) represents both a continued reluctance on the part of the large European non-DOE SWU sellers to offer SWU at prices as low as in the past, as well as a decision by one leading seller to raise its prices. The decline of the US dollar relative to most European currencies has made it impossible for European sellers to obtain the same prices *in their currencies* that could be obtained during the first half of 1985. Meanwhile, the continuing uncertainties regarding the status of the USEC have created the potential for new buyers in early 1986. Thus, lacking active buyers at present, sellers have generally resisted reducing prices and are electing to wait for new buyers to appear.

This month, a large inventory seller that had been aggressively seeking buyers was able to obtain commitments for about 60 percent of its SWU. This seller now is attempting to secure higher prices for the remaining SWU, even though there is little active demand. Although potential buyers do not appear sufficiently motivated to purchase now, Nuexco expects a number of buyers to appear in the coming months as a consequence of new market developments.

* * *

DOE INCENTIVE PRICING OFFER, FY1991-1995

The recent incentive pricing proposal for fiscal years 1991-1995 issued by DOE to all of its Utility Services contract (USEC) customers appears to lack firm economic benefits. As with DOE's previous incentive pricing proposals covering FY1987-1990, DOE is offering to sell SWU at low prices to customers with uncommitted requirements. The price per SWU under the offer is the lower of the USEC price or the price determined by the following formula:

$$\text{Price} = \$85 = \frac{(85)(\text{Im} - \text{I})}{\text{I}}, \text{ where}$$

Im = Implicit Price Deflator for the US GNP (Gross National Product) at the end of the second quarter of the calendar year preceding the fiscal year of delivery.

I = 230.55, which is the Implicit Price Deflator for US GNP for the second quarter 1985.

In order to receive this SWU price for their uncommitted requirements, a customer must agree to purchase *all* of their uncommitted requirements for FY1991-1995 from DOE under the proposal. DOE has set February 21, 1986 as the acceptance deadline.

In most cases, the proposal covers the 30 percent of requirements that USEC holders are normally allowed to purchase from sources outside their DOE contracts. It has been reported, however, that a special case exists for DOE customers that had partially terminated under their old Requirements contracts. These customers converted to the USEC under the provision that

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they would be allowed to purchase a higher percentage of their requirements on the open market for the years previously terminated. These customers also will be allowed to purchase the incentive-price SWU for those higher percentages. Conversely, a number of customers already are committed to buy more than 70 percent of their requirements from DOE as part of their USEC conversion terms. These customers will receive 30 percent of their requirements at incentive prices under the DOE proposal, regardless of the prior commitment, provided they commit to purchase 100 percent from DOE from FY1991-1995.

Concurrently, DOE agreed to waive the variable tails assay option (VTAO) fee for any year in which a USEC customer is committed to purchase 100 percent of their enrichment services from DOE. This offer commences in FY1987 and apparently extends indefinitely until revoked. DOE indicated that this offer was based on the Secretary of Energy's finding that the US uranium industry was non-viable, and was intended to help rectify this situation by increasing the use of natural uranium.

Actual Market Impact

Initial reactions to the DOE proposals among USEC customers were mixed. Some USEC holders are still concerned that the USEC will be declared null and void in court, thereby nullifying the new incentive price and VTAO offers. Moreover, a number of customers question whether any real economic benefits exist in the recently announced package.

DOE itself has produced price projections, for general distribution to its customers, which show USEC prices dropping significantly through the late 1980s and into the early 1990s. Many market analysts believe that DOE *must* lower prices approximately as projected in order to remain competitive with prices that have *already* been offered by European enrichers. Meanwhile, estimates indicate that the GNP escalator in DOE's incentive price offer could well result in an incentive SWU price of over $110 per SWU in 1991, and $130 or more per SWU by 1995, in year-of-delivery dollars. These price estimates are not much lower than either DOE's previous USEC price projections or prices offered by non-US enrichers in similar time frames. Many customers feel that any real savings resulting from the incentive price proposal could be negligible.

Likewise, the long-term benefits of the free VTAO are difficult to evaluate. In today's market, the value of specifying 0.3 percent tails assay versus 0.2 percent tails assay for 3.0 percent enriched product is worth about $17.50 per SWU, according to the following equation:

Cost of 1 kgU at 3.0 w/o = (SWU price)(SWU/Product ratio)
+ (Feed price)(Feed/Product ratio)

Using today's USEC price of $125 per SWU, and the Nuexco UF_6 value of $47 per kgU as UF_6, then:

Cost of 1 kgU at 0.3 = 125(3.42) + 47(6.57) = $736.29
Cost of 1 kgU at 0.2 = 125(4.31) + 47(5.48) = $796.31

$$\text{Price per SWU} = \frac{796.31 - 736.29}{3.42\ \text{SWU/Product}} = \$17.55 \text{ per SWU at } 0.3$$

However, the actual savings for free VTAO today would be less than $9 per SWU. The USEC established a maximum VTAO charge of 0.7 percent of the base SWU price for every 0.01 percent the tails assay exceeds 0.20 percent. For today's prices, the maximum VTAO charge for 0.3 percent tails would be 7 percent of $125, or $8.75 per SWU.

In general, the lower the SWU price and higher the feed price, the less valuable the free VTAO offer becomes. By 1991 and later, however, many customers feel that feed prices should be much higher than today, and both DOE and non-DOE SWU prices should be lower. The above calculation using $75 per kgU as UF_6 feed and $100 per SWU indicates an advantage of only about $3 per SWU when specifying the optimum 0.26 tails assay rather than 0.2 tails. Given most customers expectations of higher uranium prices by 1991-1995, the only way in which the incentive price and free VTAO proposals will show any significant savings in those years would be if DOE prices also rose substantially. Under such an unlikely scenario, DOE would not be competitive with non-US SWU suppliers in the long term, and signing the USEC would have turned out to be a mistake. This is not considered a realistic possibility.

In fact, the real benefits of the free VTAO offer appear to be in the 1987-1990 time period, when uranium feed prices for many customers are expected to remain low. Virtually all USEC customers, however, have already covered their earlier uncommitted requirements through 1990, either with DOE's first incentive pricing offer (see page 2 of Report 200, April 1985) or with a non-DOE supplier. Those customers not supplied 100 percent by DOE are unable to alter their non-DOE SWU contracts to benefit from the free VTAO offer.

Because there does not appear to be clearly demonstrable economic incentive to accept the DOE offers, USEC customers will probably make their decisions based on subjective, political considerations. Non-US customers that would have chosen

European enrichers before the announcement of the new proposal will still do so. Many US utilities will accept DOE's offer out of loyalty to DOE. But Nuexco expects some US utilities, many that have expressed concern about DOE's ability and commitment to be competitive in the long term, to continue to commit their 30 percent of requirements to non-US enrichers. They would undoubtably intend to develop relations with other SWU suppliers for the future, while assuring that DOE continues to have competition in the US market.

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December 31, 1985	Market Values	Active Supply[1] (thousands)	Active Demand[1] (thousands)
EXCHANGE VALUE	**\$17.00**/lb. U_3O_8	3,595	2,325
UF$_6$ VALUE	**\$47.00**/kgU		
CONVERSION VALUE	**\$1.60**/lb. U as UF$_6$	300	0
SWU VALUE 0.3 tails assay; delivery within one year	**\$80**/SWU		
LOAN RATE	5%/annum	2,000	0

	\$/lb. U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
TRANSACTION VALUE	**16.55**	2.1	11	3

[1] Supply and demand tables in *Current Market Data* section of this Report detail the numbers for each category.

DEFINITIONS

1. The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.
2. The **UF$_6$ Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.
3. The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.
4. The **SWU Value** represents Nuexco's judgment of the price at which transactions for the sale of significant quantities of SWUs of stated origin for delivery in the specified time period could be concluded as of the date indicated.
5. The **Loan Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.
6. The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
   a. Transactions closed within the previous three-month period for which delivery is scheduled within one year of the transaction date;
   b. At least ten transactions;
   c. Transactions involving a sum total of at least 2 million pounds U_3O_8 equivalent.

   The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

DERIVATIONS AND COMMENTS

1. All Market Values are based on:
   a. Data from recently completed transactions.
   b. Data from pending transactions.
   c. Firm bids to buy or borrow, and firm offers to sell or lend.
   d. Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell or lend.
2. Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these Market Values.
3. In the determination of the Conversion Value, Nuexco does not consider transportation charges other than those customarily provided by primary suppliers of conversion services.
4. The prices of conversion services or SWUs delivered under long-term contracts with primary suppliers are not considered in the determination of either the Conversion Value or SWU Value.
5. For the SWU Value, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight-percent U_{235} and a product assay of 3.0 weight-percent U_{235}, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
6. In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

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CURRENT MARKET DATA

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
Country (currency)	**This Month (Dec 31, 1985)**	**Last Month (Nov 30, 1985)**	**12 Months Ago (Dec 31, 1984)**	**This Month (Dec 31, 1985)**	**Last Month (Nov 30, 1985)**	**12 Months Ago (Dec 31, 1984)**
Australia (dollar)	24.92	24.31	18.37	64.78	63.20	47.77
Belgium (comm. franc)	854.70	861.18	960.33	2,222	2,239	2,497
Canada (dollar)	23.78	23.08	20.13	61.81	60.01	52.34
Finland (markka)	92.19	91.63	99.48	239.68	238.22	258.62
France (franc)	128.40	129.85	147.20	333.81	337.57	382.69
FRG (mark)	41.87	42.62	47.99	108.86	110.80	124.75
Italy (lira)	28,509	28,741	29,480	74,117	74,719	76,641
Japan (yen)	3,413	3,368	3,814	8,873	8,755	9,917
Netherlands (guilder)	47.16	47.82	54.08	122.60	124.31	140.59
South Africa (rand)	43.87	44.14	29.99	114.05	114.75	77.97
Spain (peseta)	2,621	2,625	2,638	6,815	6,825	6,857
Sweden (krona)	128.98	128.55	136.53	335.33	334.20	354.94
Switzerland (franc)	35.31	35.06	39.54	91.79	91.14	102.79
UK (pound)	11.82	11.41	13.10	30.73	29.66	34.05
US (dollar)	17.00	16.75	15.25	44.20	43.55	39.65

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
Country (currency)	**This Month (Dec 31, 1985)**	**Last Month (Nov 30, 1985)**	**12 Months Ago (Dec 31, 1984)**	**This Month (Dec 31, 1985)**	**Last Month (Nov 30, 1985)**	**12 Months Ago (Dec 31, 1984)**
Australia (dollar)	24.26	22.93	19.16	63.07	59.62	49.80
Belgium (comm. franc)	832.08	812.34	1,001	2,163	2,112	2,603
Canada (dollar)	23.15	21.77	20.99	60.18	56.60	54.57
Finland (markka)	89.75	86.43	103.72	233.33	224.71	269.64
France (franc)	125.00	122.48	153.47	324.97	318.42	399.00
FRG (mark)	40.76	40.20	50.03	105.98	104.52	130.07
Italy (lira)	27,754	27,110	30,737	72,155	70,481	79,908
Japan (yen)	3,323	3,177	3,977	8,638	8,258	10,339
Netherlands (guilder)	45.91	45.10	56.38	119.35	117.26	146.58
South Africa (rand)	42.71	41.63	31.27	111.04	108.24	81.29
Spain (peseta)	2,552	2,476	2,750	6,635	6,438	7,149
Sweden (krona)	125.57	121.26	142.35	326.45	315.25	370.07
Switzerland (franc)	34.37	33.07	41.22	89.36	85.97	107.17
UK (pound)	11.51	10.76	13.65	29.92	27.98	35.50
US (dollar)	16.55	15.80	15.90	43.03	41.08	41.34

[1] Calculated using currency exchange rates published in the *Wall Street Journal* on December 31, 1985.

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CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U as UF_6			per kg. U as UF_6		
Country (currency)	This Month (Dec 31, 1985)	Last Month (Nov 30, 1985)	12 Months Ago (Dec 31, 1984)	This Month (Dec 31, 1985)	Last Month (Nov 30, 1985)	12 Months Ago (Dec 31, 1984)
Australia (dollar)	2.35	2.32	0.96	5.17	5.12	2.13
Belgium (comm. franc)	80.44	82.26	50.38	177.34	181.36	111.06
Canada (dollar)	2.24	2.20	1.06	4.93	4.86	2.33
Finland (markka)	8.68	8.75	5.22	19.13	19.30	11.50
France (franc)	12.08	12.40	7.72	26.64	27.34	17.02
FRG (mark)	3.94	4.07	2.52	8.69	8.98	5.55
Italy (lira)	2,683	2,745	1,546	5,915	6,052	3,409
Japan (yen)	321.22	321.67	200.10	708.17	709.17	441.14
Netherlands (guilder)	4.44	4.57	2.84	9.78	10.07	6.25
South Africa (rand)	4.13	4.22	1.57	9.10	9.29	3.47
Spain (peseta)	246.72	250.78	138.36	543.93	552.88	305.03
Sweden (krona)	12.14	12.28	7.16	26.76	27.07	15.79
Switzerland (franc)	3.32	3.35	2.07	7.33	7.38	4.57
UK (pound)	1.11	1.09	0.69	2.45	2.40	1.51
US (dollar)	1.60	1.60	0.80	3.53	3.53	1.76

SWU VALUE AND UF_6 VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	SWU Value delivery within one year (December 31, 1985)	UF_6 Value per kg.U in UF_6 This Month (December 31, 1985)	UF_6 Value per kg.U in UF_6 Last Month (November 30, 1985)
Australia (dollar)	117.27	68.89	66.76
Belgium (comm. franc)	4,022	2,363	2,365
Canada (dollar)	111.89	65.73	63.39
Finland (markka)	433.84	254.88	251.64
France (franc)	604.23	354.98	356.59
FRG (mark)	197.04	115.76	117.05
Italy (lira)	134,161	78,819	78,929
Japan (yen)	16,061	9,436	9,248
Netherlands (guilder)	221.91	130.37	131.32
South Africa (rand)	206.45	121.29	121.21
Spain (peseta)	12,336	7,247	7,210
Sweden (krona)	606.98	356.60	353.03
Switzerland (franc)	166.15	97.61	96.27
UK (pound)	55.63	32.68	31.34
US (dollar)	80.00	47.00	46.00

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on December 31, 1985.

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CURRENT MARKET DATA

RECENT TRANSACTIONS[1]

Uranium Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price as Percent of Current Exchange or UF_6 Value	Seller	Buyer	Remarks
3629	1986	50-100	97	Trader	US Utility	
3628	1986	Less than 50	97	Trader	US Utility	
3627	1986	50-100	98	US Producer	US Utility	
3626	1986	101-300	97	US Producer	US Utility	
3624	1985	50-100	94	Trader	European Utility	
3615	1986	101-300	104	Trader	European Utility	
3614	1986	101-300	105	US Producer	European Utility	

Enrichment Services
Secondary Market Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity[2] (thousands of SWUs)	Approximate Price[3] as Percent of Current SWU Value[4]	Seller	Buyer	SWU Origin	Remarks
3625	1986	50-100	95	European Utility	US Utility	DOE	

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[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] If tails assay is unknown or unspecified, Nuexco's calculation of SWU quantity assumes 0.20 w/o tails assay.

[3] Price is not normalized to 0.20% tails assay.

[4] Refers to SWU Value that corresponds to SWUs included in transaction. When prices and SWU values are expressed as discounts (e.g. X dollars less than DOE's USEC base price at time of delivery), the percentage refers to the ratio of the *discounts*, not the ratio of the prices.

[5] The notation *R* means that Nuexco either does not know, or that Nuexco has restricted that information to protect client confidentiality.

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URANIUM SUPPLY
(December 31, 1985)

	Delivery Period[1] (Thousands of Pounds U_3O_8)		
Nuexco Project Number	Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
1860	500	500	UF_6
2335	275	—	
2483	70	—	
2680*	500	500 per year	1987-92
2728	350	—	
2740*	100	—	
2793	1,000	—	
2802	200	—	
2814	500	500	UF_6
2818*	100	—	UF_6
2263	—	400 per year	1987 on
2625	—	500 per year	1987 on
2778	—	220 per year	1987-90
2781	—	100 per year	1988-95
TOTAL:	3,595		
INACTIVE			
2336*	250	250 per year	1986-94
2389	75	75 per year	1986-90
2654	300	700 per year	UF_6
2746	180	—	UF_6e
2764	260	—	UF_6
2765	260	—	UF_6
2777	250	—	
2804	100	—	
2297	—	200 per year	1986-89
TOTAL:	1,675		

*New or revised since last month

[1] Measured from the date of this Report

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2737, 2771, 2825

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URANIUM DEMAND
(December 31, 1985)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or long-term	Remarks
Inquiries to Purchase:			
ACTIVE			
2733*	500	500 per year	1987-95
2743	325	—	UF_6
2748*	40	—	
2758	1,000	500	UF_6
2762	300	—	
2784	100	—	
2786*	60	—	
2217	—	1,000 per year	1989-95
2507	—	600	1987-89
2586	—	250 per year	1988-95
2681	—	500 per year	UF_6 or U_3O_8; 1987-88
2738	—	1,000	1989 on
2739	—	1,000 per year	1987-90
2760	—	750 per year	1986-90
2770	—	500 per year	1988-94
2796	—	175 per year	1988-92
2808	—	250	1989 on
2821*	—	120 per year	1988-93
2870*	—	100	1989
TOTAL:	2,325		
INACTIVE			
2548	290	—	
2798*	70	—	
2806*	1,000	—	
2643	—	150 per year	1987 on
TOTAL:	1,360		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2769, 2772, 2786.

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LOAN SUPPLY AND DEMAND
(December 31, 1985)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Within 1 Year	Beyond 1 Year	Remarks
Available for Loan:			
ACTIVE			
2805	2,000	—	
TOTAL:	2,000		
INACTIVE			
1938	2,000	—	UF_6
2036	500	—	
2667	800	—	
TOTAL:	3,330		

*New or revised since last month.
[1]Measured from the date of this Report.
Projects removed since last month: None.

No inquiries to borrow are reported this month.

CONVERSION SUPPLY AND DEMAND
(December 31, 1985)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U as UF_6) Within 3 Years	Beyond 3 Years	Remarks
Available for Sale:			
ACTIVE			
2849*	300	900	1986-90
TOTAL:	300		
INACTIVE			
2051	100	—	
TOTAL:	100		
Inquiries to Purchase:			
INACTIVE			
2724	—	375	1989-93
TOTAL:	0		

*New or revised since last month
[1]Measured from the date of this Report
Projects removed since last month: None

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CURRENT MARKET DATA

SWU SUPPLY AND DEMAND
(November 30, 1985)

	Delivery Period[1] (Thousands of SWUs)		
Nuexco Project Number	Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
2410A	350	—	
2705*	100	—	
2571	—	55	1987
TOTAL:	450		
INACTIVE			
2652	—	25	
2746	100	—	1986
TOTAL:	100		
Inquiries to Purchase:			
INACTIVE			
2761	115	—	
2797	—	150	1988-89
TOTAL:	115		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2400.

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SURFICIAL URANIUM DEPOSITS — PART TWO

This is the second part of a two-part article on surficial uranium deposits. Part One appeared in Report 208, December 1985.

Distribution of Deposits

The identification of surficial uranium has become increasingly more frequent since calcrete deposits were discovered in Australia and Africa during the early 1970s. Deposits confined to the four climatic environments described in Part One are known to occur in a number of locations throughout the world. Studies indicate that as much as 10 to 15 percent of global uranium resources could be contained in surficial deposits.[1] However, the economics of recovery will continue to determine the commercial availability of surficial uranium. Few (if any) such deposits could be exploited and marketed successfully under current market conditions.

Australia — The greatest resource potential for surficial uranium is associated with the calcrete-type deposits in arid climates. Significant deposits of this type occur in Western Australia, the largest being Yeelirrie. It is estimated to contain over 50,000 metric tons U_3O_8 at an average grade of 0.15 percent uranium. The deposit is situated in a large paleodrainage system in a calcrete and dolocrete environment. Uranium has accumulated by the process of evaporation and precipitation from uranium-bearing groundwater. Carnotite is the only uranium mineral present in the deposit.

The Yeelirrie deposit is situated in the northern part of a large granitic area referred to as the Yilgarn Block. The entire region has undergone extensive weathering and geologic change. Forty to fifty separate uranium occurrences have been discovered in the Yilgarn Block; eight of them have been thoroughly detailed and considered for exploitation at various times. Two of the better-known deposits in that group are Lake Way and Minindi Creek. Each of the eight deposits has characteristics similar to Yeelirrie; they are confined to a fluviatile or playa depositional environment. The age of the Yilgarn Block deposits has been estimated at between 25,000 years and 750,000 years. The younger deposits in the Yilgarn Block are likely to have been formed by redistributed uranium from the older deposits.

Namibia — At least ten important surficial uranium deposits have been discovered in the central Namib Desert region of Namibia. Six of the ten deposits, of which the Langer Heinrich is the largest, together contain over 30,000 metric tons of U_3O_8. The other five deposits are Spitskoppe and Trekkopje to the north, and Tumas, Tubas and Aussinanis to the south. All deposits occur in the Langer Heinrich and Tumas channel-filling formations consisting of fine to large boulder conglomerates. The formations are part of the Namib Group of Tertiary age, which have filled meandering paleochannels cut into the Damara basement rocks. All but one deposit has developed in a calcite (calcrete) or dolomite (dolocrete) environment. One deposit, Tubas, is associated with gypsiferous (gypcrete) sediments in the Tumas formation. Carnotite is the uranium mineral present in all deposits, occurring in close association with the cementing minerals.

Other Africa — Fluviatile and playa deposits of less important size and grade occur in arid to semi-arid climates of South Africa, Botswana, Algeria and Somalia. The uranium occurs as an evaporite or a precipitant in Tertiary sediments, usually associated with calcite or gypsum. Carnotite is again the most common uranium mineral, but torbernite and autunite have been recognized in certain deposits. The deposits in Botswana may have formed through evaporation of uranium-bearing water moving by capillary action upward through Karoo sediments into the lower Kalahari sediments. All of these deposits are small and none are under consideration for development. (A number of similar deposits have been found in Argentina. Some of those deposits are being exploited, even though the average uranium content is relatively low.)

Europe — Uranium occurrences in the cold climate wetland belt are known to exist in the United Kingdom, Sweden and Finland. An organic-rich environment, one in which uranium was absorbed by the organic matter, is common to all occurrences. The European occurrences are perhaps more of a mineral curiosity than a deposit. Every occurrence is associated with a peat bog overlying bedrock of uraniferous granite.

Five peat bogs in the United Kingdom are known to contain uranium values of less than 600 ppm. In each case, potential tonnage of uranium is extremely small. Finland is known to have at least 20 peat bogs with evidence of contained uranium. The uranium values in seven bogs were determined at between 0.10 percent and 2.40 percent U_3O_8. The occurrences are also small and represent only a limited resource base.

Sweden conducted a nationwide search for uranium during the 1950s. A large number of uranium-bearing peat bogs were recorded, three of which were found to contain uranium at grades of 0.20 percent to 3.40 percent U_3O_8. Geologists consider the source of uranium to be deepseated spring water originating from uranium-enriched granites; the water then contacts with the organic matter along normal surface drainage channels. In all cases, radioactivity is extremely low and the presence of uranium was determined through geochemical sampling and confirmed by chemical analysis. All occurrences are too small to mine for uranium. However, if the peat is used as a fossil fuel, the ash can be collected and processed for the recovery of uranium and other contained metals such as vanadium and molybdenum.

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[1] Toens, P.D., Surficial Uranium Deposits, IAEA-TECDOC-322, 1984, page 7.

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Canada — A few of the organic-rich deposits in western Canada and the northwestern USA may have grade and tonnage potential to be of commercial interest under reasonably better market conditions. The deposits in Canada are all located along the north-south trend of the Okanagan Valley region, within the central dry belt of British Columbia. A number of uranium occurrences have been discovered in semi-arid, alpine and permafrost environments within the southern portion of the region.

The geology of the region is complex, with Eocene (Tertiary) volcanics and sedimentary rocks filling small structural and erosional depressions within a basement complex of intrusive and metamorphic rocks. Tertiary tectonics followed the Eocene volcanics and created extensive block faulting in the northern region with moderate block faulting and north-south faults in the southern portion. Much of the region is covered by glacial debris up to 1,200 meters thick in the basin lowlands.

Surficial uranium is restricted to fluviatile and lacustrine/playa environments almost always underlain by intrusive rocks, which are the source of uranium and associated mineralization. The mineralization develops in soils as an evaporite and as a precipitate in sediments at a depth of approximately three meters. Where organic-rich sediments are present, adsorption of uranium is commonplace. The highest uranium values are usually at or near the surface. The mineralization is highly mobile and deposits are being depleted and reconstituted at all times. No uranium mineral has been identified. Molybdenum is regularly associated with the uranium on a ratio of about 1:1. Small surficial uranium deposits have been noted in similar environments in Nova Scotia and New Brunswick.

The Blizzard and Tyee uranium deposits are the largest in the region, with a combined in-place reserve of about 12 million pounds U_3O_8. Both deposits were considered for exploitation in 1980, when the provincial government initiated a seven-year ban on uranium mining. Since the moratorium, uranium exploration in British Columbia has virtually ceased.

United States — Calcrete-type uranium deposits have been identified in the Texas Panhandle area to the south of Lubbock, Texas (about 500 miles northwest of the South Texas Plains uranium district). Mineralization formed in the upper Ogallala Formation of Miocene age in a semi-arid to arid climate. Successive wet and dry periods produced a calcrete zone two to three meters thick. Carnotite mineralization is associated throughout the full thickness of the zone. The general region was uplifted in the Late Pleistocene era and the calcrete deposits are now exposed and are actively eroding away due to present drainage patterns. Known deposits are small and low-grade, with the uranium content measured in parts per million. There is some potential that additional deposits will be located throughout the Panhandle region occupied by the Ogallala Formation, but the combined resource and economic potential for Ogallala deposits is probably negligible.

Young uranium deposits associated with organic-rich sediments occur at several different locations in the western USA. Deposits have been discovered in northern Idaho, northeast Washington, the Colorado Front Range and the Lake Tahoe area of California and Nevada. The deposits are generally located within a cold temperate belt associated with heavy moisture accumulations during the winter and hot dry summers. Uranium is carried in solution and accumulates by adsorption on organic matter and by precipitation in unconsolidated and interbedded sediments.

Known surficial deposits in northeastern Washington have the same basic geologic environment — Recent sediments covering Precambrian intrusives and metamorphic rocks. The area is covered by glacial material which may be tens of meters thick. Extensive erosion has created long narrow valleys (fluviatile) which have received post-glacial sediments, in addition to organic-rich material in meadow and swamp/bog environments. Intrusives act as the source of uranium. It is leached out by solution activity, primarily during the seasonal runoff period. As the uranium-bearing water passes through the organic-rich sediments, uranium is adsorbed by the organic matter. The uranium remains highly mobile and is continually reconstituted within the immediate area or redeposited downstream in new host conditions.

Permeability of the host sediments is a major determinant of the accumulation of uranium. The highest uranium values are in shallow organic-rich zones, from grass roots to a depth of one or two feet; below that, to a depth of two or three meters, the organic content and degree of uranium mineralization decrease. The positioning of mineralization can be reversed if flooded by rising groundwater for an extended time. Uranium enrichment will occur throughout the flooded zone. Subsequently, precipitation of uranium will take place in the unconsolidated sediments as the groundwater level recedes.

Development

Development attempts have been made at only one surficial uranium deposit in the USA. Mining operations began in 1983 on the Flodelle Creek deposit, located along the upper North Fork of the Flodelle Creek drainage basin in northeast Washington. Joy Mining Company of Spokane, Washington, the owner and operator, has suspended mining pending improved market opportunities.

Uranium was first detected in the area in 1976 by geochemical sampling in the streams draining the granitic highlands. Follow-up geologic geochemical studies determined that the granitic rocks are moderate-to-highly altered and readily supply uranium and associated metals to solution. The course of uranium-charged solutions was carefully charted throughout the drainage system. The studies also determined that uranium deposition occurred primarily in sedimentary fill behind a sequence of beaver dams common to the drainage environment. Beaver ponds became natural traps for the accumulation of organic-laden sediments, thereby creating the proper geochemical environment for the development of surficial uranium deposits along the drainage system.

A detailed trenching and drilling campaign was conducted within areas of interest, and the results established the existence of uranium within organic matter and fine-grained sediments from one to 16 feet thick (4.8 meters). The average thickness is 1.5 meters. Isolated uranium values exceeded 1.00 percent U_3O_8. The highest uranium values are confined to the organic matter within four to twelve inches of the surface, suggested that uranium is still accumulating. The sampling program detailed an area of slightly more than six acres containing in-place uranium reserves of approximately 865,000 pounds U_3O_8. Figure 1 shows a profile of the upper portion of uranium-enriched soil and unconsolidated sediments at the Flodelle Creek mine.

Figure 1. Profile-view of uranium-bearing organic soil and unconsolidated sediments at the Flodelle Creek mine. The upper soil zone (surface to line) has highest uranium content, up to 0.90% U_3O_8, below the line 1-2 meters is low-grade — 0.03 to 0.40%. Water in pit conceals lower 2 meters of mineralized material.

Joy Mining Company completed metallurgical studies and obtained permits for mining the deposit in 1982. Mine development began in 1983 with preparations for draining of the meadow area by diverting normal stream flow. Developers selected a mill site on a terrace about 25 feet above and 300 feet east of the meadow; construction on a 70,000 pound-per-year mill began soon after permits were granted. Mined ore was piled to one side to dry for about 45 days, then moved to the ore stockpile at the mill. After the ore was rototilled to break up oversized pieces, moisture content had been reduced to about 40 percent and the ore was ready for milling.

The recovery process began with ore dumped into concrete filter bottom vats; ferric sulfate leach was percolated through the ore for a period of 24 hours. Figure 2 shows one of three leach vats. The pregnant ferric sulfate liquor was stripped by amine in a kerosene carrier. Leached ore was washed and removed from the leach tank; due to the lack of radioactive decay products in the ore, spent tailings were returned directly to the mined-out meadow. Uranium was extracted from the loaded amine with an ammonium sulfate wash, and precipitated with magnesium oxide. The uranium oxide was filtered, dried and packaged for shipment. Figure 3 shows the inside of the mill. Radioactive wastes from the mill process were recycled to the leach circuit; spent radioactive and chemical effluents were discharged to a lined waste pond. Several other deposits within the Flodelle Creek drainage system may eventually be mined, with processing taking place at existing facilities. A total of approximately 1,200,00 pounds U_3O_8 are available for mining.

Figure 2. One of three leach vats at end of leaching cycle. Leached material is being removed to waste pile.

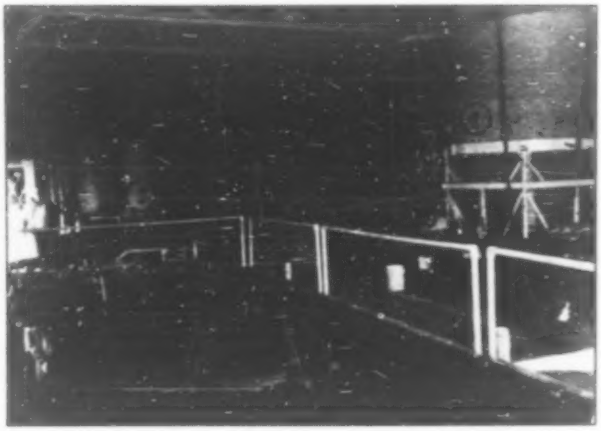

Figure 3. Inside view of the Flodelle Creek uranium mill. 1 = Pregnant liquor storage and wash circuit; 2 = ion exchange circuit; 3 = precipitation and drying circuit.

Conclusions

Surficial uranium deposits are an integral part of world resources. Certain deposits, primarily calcrete-type in Western Australia and Namibia, and young deposits in British Columbia, represent significant resources. However, until some of the deposits are exploited with economic success, surficial deposits should not be included among uranium reserves. Neither will the future of the industry be greatly influenced by resources from surficial deposits. The large Tertiary deposits are non-competitive in today's market. However, some recent deposits, though small, could prove economic if environmental and reclamation problems can be minimized. At least 40 to 50 possible uraniferous sites have been identified and await evaluation in the northeast Washington/northern Idaho district alone.[1] Thus, surficial uranium deposits may present another option for the exploration industry, especially in the USA, where alternative production techniques are becoming more attractive.

Acknowledgement

Surficial Uranium Deposits, (IAEA-TECDOC-322), Vienna, 1984), is an excellent collection of papers on surficial uranium assembled by the International Atomic Energy Agency (IAEA). It describes occurrences worldwide, with special coverages on important deposits and districts. It was of considerable use in formulating ideas and conclusions expressed in this article.

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[1] J. K. Otton, US Geological Survey, October 1985.

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AUSTRALIA

As anticipated, Western Mining Corporation and BP Australia announced in early December that the Olympic Dam project would go forward. While there had been some speculation that a decision might be deferred until it was possible to firm up purchase contracts for the planned output, the partners committed on the basis of sales negotiations that were, in their words, "proceeding satisfactorily." If, in fact, the project proceeds on schedule, uranium production would begin in 1988 at an annual rate of 4.4 million pounds U_3O_8. Notwithstanding the positive tone of the partner's announcement, placing such quantities, particularly in the early years of production, is likely to prove extremely difficult given current market conditions and the existing floor price policy of the Australian government. In addition, the partners will face stern competition for available sales opportunities, both from within their own country as well as from Canadian, African and other producers.

In this context recent statements by John Bannon, Premier of South Australia, take on added interest. Mr. Bannon is reported to have said that the federal government was monitoring the Australian uranium floor price and had agreed to adjust the way it would apply to uranium produced from the Olympic Dam project. Neither state nor federal authorities have responded to inquiries to clarify the basis of and authority for Mr. Bannon's comments. But his statement taken at face value, together with repeated rumors and news stories about possible changes in the floor price policy reinforce the perception that changes in that policy appear inevitable. However, in view of the political sensitivity of the uranium issue, any near-term official pronouncement is unlikely. The government appears inclined to leave the matter unresolved, acting only when and if forced to as a consequence of market developments.

A sustained strengthening of spot prices to the US $25-30 level would solve the government's problem by obviating the need to take any action at all. Conversely, if the current rise were to stall below the US $20 level, or if prices were to weaken again, some action on the floor price would likely be needed to enable the partners to sell their production.

CORRECTION

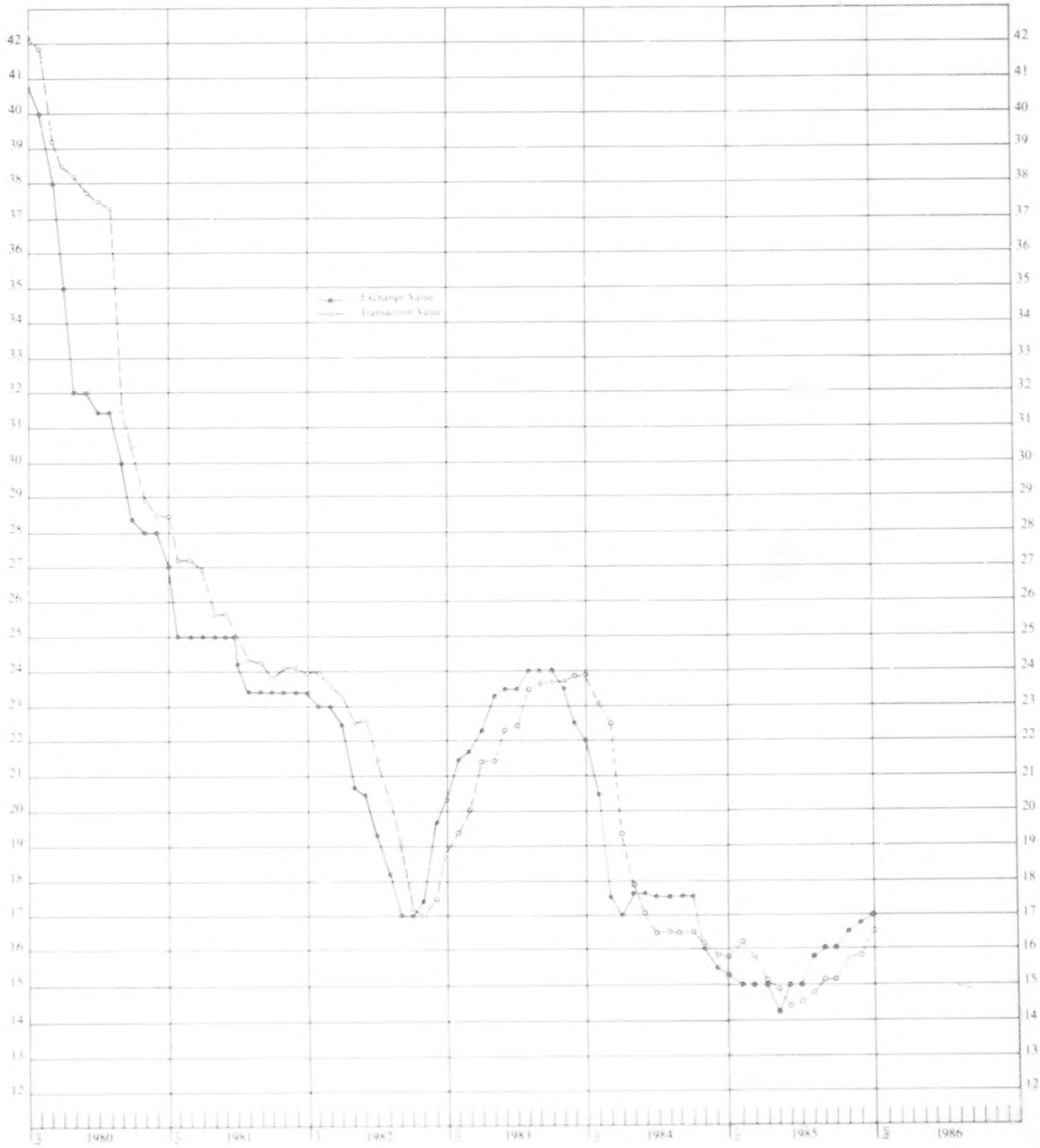
In the FOCUS article on Belgium's nuclear power program (Report 208, December 1985), an item on page 14 incorrectly stated that Synatom manages the nation's nuclear plants. That reference should have read:

Fuel procurement *and fuel management for* the seven Belgian nuclear reactors (except for fabrication and in-core management) is handled by Synatom SA, located in Brussels.

HISTORICAL MARKET DATA

EXCHANGE AND TRANSACTION VALUES SINCE JANUARY 1980

Determined as of the last day of the month indicated



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HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	32.50	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	**17.00**

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	**16.55**

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U as UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	**1.60**

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GOVERNMENT STATISTICS

AUSTRALIA

	Price Index of Materials Used in Manufacturing Industry—All Groups[1] **(1969=100)** **(1976=100)**	**Award Rates of Pay Indexes Australia—Adult Males In Mining Wage and Salary Earners, Weekly Rates**[2]
1975 Avg.	150.4	132.6
1976 Avg.	168.4	160.9
1977 Avg.	192.0	179.0
1978 Avg.[3] [4]	198.5	190.0
1979 Avg.	248.8	127.9
1980 Avg.	321.8	140.8
1981 Avg.	355.3	154.1
1982 Avg.[5]	368.6	174.9
1983 Avg.	401.2	181.8
Jan 1984	399.2	188.7
Feb 1984	402.5	188.6
Mar 1984	403.9	188.4
Apr 1984	404.2	196.2
May 1984	403.8	197.0
Jun 1984	404.9	197.4
Jul 1984	408.3	197.4
Aug 1984	413.2	197.4
Sep 1984	411.9	197.4
Oct 1984	408.5	197.4
Nov 1984	407.1	197.4
Dec 1984	406.0	197.4
FY84 Avg.[6]	402.1	—
FY85 Avg.[6]	422.2	—
Jan 1985	409.3	197.4
Feb 1985	416.1	197.4
Mar 1985	430.9	197.4
Apr 1985	440.8	202.3
May 1985	454.4	202.3
Jun 1985	458.9	202.4
Jul 1985	459.0	202.3
Aug 1985	454.9	202.4
Sep 1985	447.7	202.4
Oct 1985	—	202.4

P = Preliminary   R = Revised since last month

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[1] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0).

[2] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

[3] Monthly data for 1970-78 appear on pages 4.7 and 4.8 of Report 138.

[4] Annual averages prior to 1979 reflect index base no longer in use.

[5] Monthly data for 1979-82 appear on page 35 of Report 184.

[6] Annual averages are for financial year ending June 30.

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CANADA

	Industry Selling Price Index: Manufacturing[1] (1971 = 100)	Wage-earner Data: Average Hourly Earnings (C$)[2] Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells[3] (SIC 051-099)	Primary Metal Industries Non-ferrous[4] (SIC 296)	Primary Metal Industries Non-ferrous[4] (SIC 298)	Chemicals and Chemical Products[5] (SIC 372-379)
1979 Avg.[6]	217.9	—	9.60	9.66	—	—	7.67
1980 Avg.	247.2	—	10.58	10.80	—	—	8.50
1981 Avg.	288.7	—	12.02	12.23	—	—	9.53
1982 Avg.[7]	288.8	—	13.74	13.92	—	—	10.63
1983 Avg.	298.8	—	—	14.30	—	—	11.17
Jan 1984	305.4	17.74	15.27	14.74	11.91	10.84	11.69
Feb 1984	306.6	17.90	15.59	14.90	12.04	10.82	11.51
Mar 1984	308.7	18.05	15.52	14.82	12.14	10.84	11.58
Apr 1984	310.5	18.06	15.83	15.10	11.96	10.34	11.63
May 1984	310.6	18.48	15.64	15.06	12.11	10.16	11.65
Jun 1984	311.0	18.08	15.48	14.80	12.38	10.40	11.66
Jul 1984	312.9	17.81	15.72	14.92	12.53	10.18	11.82
Aug 1984	312.7	17.24	15.36	14.92	12.44	10.34	11.78
Sep 1984	312.3	17.68	15.96	15.34	12.51	10.52	11.90
Oct 1984	312.3	17.64	16.15	15.26	12.69	10.56	11.96
Nov 1984	313.6	18.04	16.13	15.43	12.47	10.51	11.96
Dec 1984	314.2	17.95	16.39	15.60	12.16	10.40	11.99
1984 Avg.	310.9	17.88	—	15.07	12.28	10.49	11.76
Jan 1985	315.9	18.05	16.13	15.60	12.32	10.80	12.04
Feb 1985	316.5	18.78	16.41	15.68	12.52	11.05	12.06
Mar 1985	318.0	18.24	16.21	15.57	12.44	10.97	12.02
Apr 1985	318.3	18.63	16.44	15.80	12.81	11.23	12.04
May 1985	318.8	19.41	16.51	15.63	12.76	11.25	12.15
Jun 1985	319.1	18.49	16.20	15.49	12.89	11.14	12.14
Jul 1985	319.4	18.14	16.19	15.41	12.96	11.17	12.13
Aug 1985	319.2	17.07	15.76	15.30	12.97	11.31	12.19
Sep 1985	319.4	17.92P	16.16P	15.61P	12.94P	11.38P	12.40P
Oct 1985	320.2P	—	—	—	—	—	—

P = Preliminary R = Revised since last month

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[1] Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision.

[2] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours" (Catalogue 72-002).

[3] Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

[4] Beginning with the April 1983 figure, Primary Metal Industries, non-ferrous is split into SIC 296 and SIC 298.

[5] Chemical and Chemical Products prior to April 1983 was SIC 370-379. The new series is from a new survey which includes all companies and is based on a 1970 classification. The old survey only included companies of 20 employees or more.

[6] Monthly ISPI for 1977 and 1978 appear on page 4.10 of Report 138, and monthly wage-earner data for 1973-78 appear on page 4.11 of Report 138.

[7] Monthly data for 1979-1982 appear on page 37 of Report 184. On that page, the wage earner index entitled "Metal Mining, Including Milling (SIC 050-099)" should read "Total Mining (SIC 051-099)."

[8] Beginning with the April 1983 figure, Wage Earner Data are based on a census of all companies employing 200 or more wage earners, *plus* a random survey of companies employing fewer than 200 wage earners. Prior to April 1983 only companies employing 200 or more wage earners are included in the Wage Earner Data.

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GOVERNMENT STATISTICS

REPUBLIC OF SOUTH AFRICA

		Average Declared Working Costs per per Metric Ton of Gold Ore Milled (Rand)[1]	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100)[2]	Consumer Price Index[3] (1980 = 100)[4]	Producer Price Index All Groups[5] (1980 = 100)	Total Employment in Mining and Quarrying (Code 35)[6]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[6]
1975	Avg.	16.71	—	157.2	100.0	639,473	1,003,617
1976	Avg.	19.30	—	174.7	115.1	671,240	1,212,983
1977	Avg.	23.87	—	194.4	130.0	712,006	1,420,670
1978	Avg.	27.14	—	137.2	142.7	664,571	1,537,169
1979	Avg.[7]	30.18	—	155.3	164.5	692,209	1,830,632
1980	Avg.[8]	35.53	—	176.7	192.1	714,379	2,279,615
1981	Avg.	41.89	—	206.5	218.3	728,506	2,820,505
1982	Avg.[9]	47.25	104.2	233.5	248.7	707,552	3,246,071
1983	Avg.	51.87	115.0	262.2	274.8	696,579	3,644,772
Jan	1984	—	—	274.7	283.3	689,807	326,619
Feb	1984	—	—	278.4	286.5	702,553	335,906
Mar	1984	55.30	123.1	281.9	288.0	715,628	342,332
Apr	1984	—	—	286.1	290.2	712,963	327,550
May	1984	—	—	288.3	292.6	710,040	327,937
Jun	1984	56.95	126.2	291.2	295.3	717,009	347,121
Jul	1984	—	—	295.1	296.0	717,121	369,964
Aug	1984	—	—	297.0	300.8	721,905	361,357
Sep	1984	60.64	133.2	299.9	304.1	721,470	359,218
Oct	1984	—	—	303.7	308.7	717,865	363,755
Nov	1984	—	—	307.4	312.8	717,396	369,771
Dec	1984	62.92	138.6	309.4	315.9	701,198	365,234
Jan	1985	—	—	177.1	166.6	711,366	376,777
Feb	1985	—	—	182.8	171.3	727,932	361,823
Mar	1985	64.48	142.4	183.6	173.0	708,809	371,380
Apr	1985	—	—	187.4	174.0	724,187	369,005
May	1985	—	—	189.5	177.7	708,085	373,478
Jun	1985	67.42	148.9	191.9	179.2	724,587	395,543
Jul	1985	—	—	193.6	180.7	738,228	419,106
Aug	1985	—	—	195.6	183.2	734,121	416,777
Sep	1985	70.47	155.3	197.8	184.8	—	—
Oct	1985	—	—	200.8	188.1	—	—
Nov	1985	—	—	203.4	—	—	—

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[1] Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly.

[2] Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

[3] Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."

[4] The basis for calculation prior to January 1985, 1975 = 100. For annual averages prior to 1978, April 1970 = 100.

[5] Previously known as the Wholesale Price Index, now the Producer Price Index. The computation remains the same. The basis for calculation prior to January 1985, 1975 = 100.

[6] Bulletin of Statistics, Department of Statistics, Pretoria.

[7] Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 4.9 of Report 140.

[8] Monthly data for Codes 35 and 40, 1977-1980, appear on page 28 of Report 157.

[9] Monthly data for 1979-82 appear on page 39 of Report 184.

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UNITED STATES

GOVERNMENT STATISTICS

	Producer Price Index[1]		Consumer Price Index[2]	GNP Implicit Price Deflator[3]	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4]			
	Industrial Commodities (1967 = 100)	All Commodities (1967 = 100)	(1967 = 100)	(1972 = 100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1978 Avg.[5]	209.4	209.3	195.4	150.42	8.23	8.56	7.02	5.82
1979 Avg.	236.5	235.6	217.4	163.42	9.27	9.50	7.60	6.32
1980 Avg.	274.8	268.8	246.8	178.64	10.26	10.63	8.30	6.94
1981 Avg.	304.1	293.4	272.4	195.51	11.55	11.98	9.12	7.62
1982 Avg.[6]	312.3	299.3	289.1	207.15	12.33	12.94	9.96	8.21
1983 Avg.	315.8	303.1	298.4	215.63	12.57	13.43	10.59	8.65
Jan 1984	319.1	308.0	305.2	—	12.68	13.37	10.88	8.91
Feb 1984	320.6	308.9	306.6	—	12.83	13.33	10.87	8.91
Mar 1984	321.9	311.0	307.3	220.58	12.89	13.32	10.96	8.94
Apr 1984	322.5	311.4	308.8	—	12.94	13.29	10.94	8.94
May 1984	323.3	311.7	309.7	—	13.02	13.36	11.99	8.94
Jun 1984	323.9	311.4	310.7	222.40	12.99	13.39	11.00	8.97
Jul 1984	324.0	312.0	311.7	—	13.06	13.34	11.09	9.00
Aug 1984	323.5	310.9	313.0	—	13.15	13.50	11.09	9.05
Sep 1984	322.3	309.5	314.5	224.57	13.23	13.38	11.20	9.13
Oct 1984	323.2	309.4	315.3	—	13.26	13.53	11.29	9.15
Nov 1984	323.8	310.4	315.3	—	13.27	13.74	11.31	9.20
Dec 1984	323.0	309.9	315.5	226.10	13.32	13.64	11.34	9.32
1984 Avg.	322.6	310.3	311.1	223.43	13.05	13.43	11.08	9.04
Jan 1985	322.9	309.5	316.1	—	13.29	13.70	11.39	9.33
Feb 1985	322.5	309.2	317.4	—	13.30	13.73	11.39	9.33
Mar 1985	322.6	308.7	318.8	229.07	13.29	13.95	11.37	9.39
Apr 1985	323.8	309.3	320.1	—	13.43	13.62	11.48	9.40
May 1985	325.3	309.8	321.3	—	13.24	13.59	11.46	9.39
Jun 1985	324.8	309.2	322.3	230.55	13.23	13.66	11.52	9.46
Jul 1985	324.4R	309.0	322.8	—	13.45	13.82	11.60	9.47
Aug 1985	323.6	307.2	323.5	—	13.55	13.69	11.62	9.50
Sep 1985	322.5	305.8	324.5	231.85	13.44R	13.66	11.67R	9.55R
Oct 1985	324.4	308.0	325.5	—	13.45P	13.65P	11.71P	9.56P
Nov 1985	325.0	309.7	326.6	—	—	—	11.84P	9.63P

P = Preliminary R = Revised since last month

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[1] US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

[2] US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items.

[3] US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

[4] US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for 1977-1978 are adjusted to the March 1979 benchmark. Data for January 1979 and beyond are adjusted to the March 1980 benchmark.

[5] Monthly data 1970-1978 for Producer Price Index-Industrial Commodities, Consumer Price Index, and Employment and Earnings SIC codes 10, 333, and 28, and quarterly data for GNP Implicit Price Deflator appear on pages 4.6-4.8 of Report 139.
Monthly data 1977-1978 for Employment and Earnings SIC Codes 10, 333, and 28 appear on page 33 of Report 147.
Monthly data 1970-1978 for Employment and Earnings SIC Code 36 appear on page 23 of Report 154.
Monthly data 1977-1980 for Producer Price Index-All Commodities, appear on page 21 of Nuexco Report 158.

[6] Monthly data 1979-1982 for all listed indices appear on page 41 of Report 184.

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REPRESENTATIVES AND CONSULTANTS

AUSTRALIA

Peter Stork
Oratom Consulting*
5 Gould Ave.
St. Ives
NSW 2075, Australia
Telephone: (61-2) 449-6783
Telex: 23976 (COMTLX)

JAPAN

Kazy Yokota
Japan Tech Services*
Ohkura Building (3F)
1-4-10 Shiba Daimon
Minato-ku, Tokyo, Japan
Telephone: (81-3) 431-6031, 6025
Telecopy: (81-3) 434-6674
Telex: 242-5060 (JATECH J)

SOUTH AFRICA

Chris I. Von Christierson
Southern Prospecting (Pty) Limited*
P.O. Box 61409
Marshalltown 2107
Republic of South Africa
Street Address:
10th Floor
Eagle Star House
70 Fox Street
Johannesburg 2001
Telephone: (27-11) 838-1868
(27-11) 834-4211
Telex: 4-89878 SA

TAIWAN

Edward Bee
Bee & Liang Company, Ltd.*
14 FL Universal Business Center
NO. 663, Tun Hwa South Road
P.O. Box 1396
Taipei, Taiwan R.O.C.
Telephone: (886-2) 704-9630
TWX: 785-11570 (BEELIANG)

UNITED STATES

Harold C. Lindberg*
83-A Hardee Lane
Whispering Pines, N.C. 28327
Telephone: (919) 949-3622

Ralph O. Smith*
141 Braemar Drive
Cheshire, Connecticut 06410
Telephone: (203) 272-6246

SPECIAL CONSULTANTS

James C. C. Stewart
U.K. Nuclear Industry

Claus C. Thiesen
Japan Nuclear Industry

W. Bryan Webster
International Business Development

J. Robert Wolcott
International Business Development

*Independent contractors representing Nuexco

NUEXCO

EXECUTIVE SUMMARY
REPORT 209
(All data as of December 31, 1985)

Exchange Value **\$17.00, up \$0.25**	The **Exchange Value** is **\$17.00** per pound U_3O_8, up \$0.25 since last month.
UF_6 Value **\$47.00, up \$1.00**	The **UF_6 Value** is **\$47.00** per kilogram U as UF_6, up \$1.00 since last month.
Transactions	Seven recent natural uranium sales are reported, involving approximately 900 thousand pounds U_3O_8 equivalent. All of the sales involved spot or near-term delivery and also met the conditions for inclusion in the Transaction Value.
Supply-Demand Ratio **fell to 1.5:1**	Active spot and near-term **uranium supply** amounts to **3.6 million** pounds U_3O_8 equivalent, down 20 thousand pounds since last month. Active spot and near-term **uranium demand** totals **2.3 million** pounds, up 55 thousand pounds. The spot and near-term **supply-demand ratio** fell to **1.5:1.**
Transaction Value **\$16.55, up \$0.75**	The **Transaction Value** is **\$16.55** per pound U_3O_8, up \$0.75 since last month. The calculation includes 11 transactions involving a total of 2.1 million pounds U_3O_8 and equivalent UF_6, and covers a period of 3 months.
Loan Rate **unchanged at 5%**	The **Loan Rate** is **5 percent** per annum, unchanged.
Conversion Value **unchanged at \$1.60**	The **Conversion Value** is **\$1.60** per pound U as UF_6, unchanged since last month. Active secondary market supply for conversion services for delivery within three years totals 300 thousand pounds U as UF_6. No active demand or/and no secondary market conversion transactions are reported.
SWU Value for **delivery within** **one year: \$80**	The **SWU Value** at .3 tails and for delivery within one year is **\$80** per SWU. One secondary market SWU transaction, involving 50-100 thousand DOE-origin SWUs, is reported.

* * *

Raw Materials	Part Two of a two-part article on surficial uranium deposits describes characteristics of this unconventional type uranium occurrence as it appears in various regions throughout the world, and examines some established recovery techniques. Part One appeared in Report 208 (December 1985).
Australia	The recent announcement by the Olympic Dam joint venture partners to commit to the Roxby Downs project ended speculation that the decision would be deferred until firm delivery contracts could be secured. Nevertheless, finding buyers for the projected annual production of 4.4 million pounds U_3O_8 is likely to prove difficult given current market conditions and the existing government floor price policy.
1985 Index	This Report includes an index to Reports published in 1985 (197-208).

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NUEXCO REPORT 209 FIGURES OF THE MONTH (December 31, 1985)	**This Month (Report 209)**	**Last Month (Report 208)**	**12 Months Ago (Report 197)**
Exchange Value[1]	17.00	16.75	15.25
Transaction Value[1]	16.55	15.80	15.90
UF_6 Value[2]	47.00	46.00	—
Loan Rate[3]	5%	5%	6%
Conversion Value[4]	1.60	1.60	0.80
Near-Term Uranium Supply[5]	3.6	3.6	3.6
Near-Term Uranium Demand[6]	2.3	2.3	1.3
Near-Term Supply-Demand Ratio	1.5	1.6	2.9
Recent Uranium Sales:			
Number of Transactions[7]	7	1	7
Quantity of Material[8]	0.9	0.2	2.6
Nuexco SWU Value:[9]			
at 0.3 tails assay and delivery within one year	80	—	—
USDOE SWU Prices:			
USEC	125.00[10]	125.00[10]	135.00
AFC	153.00[11]	153.00[11]	153.00[11]
Requirements	157.00[11]	157.00[11]	157.00[11]
Market Value of Enriched UF_6[12,13]:			
2.5 w/o U_{235}	460	451	507
3.0 w/o U_{235}	589	578	657
3.5 w/o U_{235}	720	707	810
4.0 w/o U_{235}	854	837	965

---

[1] US $ per pound U_3O_8 equivalent.

[2] US $ per kilogram U as UF_6.

[3] Per annum.

[4] US $ per pound U as UF_6.

[5] Active inquiries to sell, for delivery within 12 months after contract signing (millions of pounds U_3O_8).

[6] Active inquiries to purchase, for delivery within 12 months after contract signing (millions of pounds U_3O_8).

[7] Uranium sales only; does not include loans, conversion, or SWU transactions.

[8] Millions of pounds U_3O_8, equivalent.

[9] US $ per SWU.

[10] Effective 10/1/85.

[11] Effective 10/1/84.

[12] Calculated using the Nuexco Exchange Value, Conversion Value, and 0.30 percent tails assay. From 4/30/85 to 11/30/85, calculations used in the Nuexco SWU Value for DOE origin and delivery by the end of FY86. As of 12/31/85, calculations use the SWU Value for delivery within one year.

[13] US $ per KgU as UF_6, rounded to the nearest $.

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FEBRUARY 1986 NUMBER 210

MONTHLY REPORT

ON THE NUCLEAR FUEL MARKET

NUEXCO

HEADQUARTERS

Three Park Central
1515 Arapahoe Street
Suite 1045
Denver, Colorado 80202
Telephone: (303) 893-4015
Telecopy: (303) 825-4821
Telex: 450202 (NUEXCO DVR)

Chairman of the Board of Partners
Oren L. Benton

Vice Chairman of the Board of Partners
Samuel R. Freeman

EASTERN UNITED STATES

100 Prospect Street
Century Plaza South
Stamford, Connecticut 06901
Telephone: (203) 323-1999
Telecopy: (203) 325-1483
Telex: 4750124 (NUEXCO C)

Managing Broker
Earl E. Hoellen, Jr.

WESTERN UNITED STATES

Building 3, Suite 290
3000 Sand Hill Road
Menlo Park, California 94025
Telephone: (415) 854-1510
Telecopy: (415) 854-2115
Telex: 470674 (NUEXCO UI)

Managing Broker
George White, Jr.

EUROPE

13 chemin du Levant
01210 Ferney-Voltaire
France
Telephone: (33-50) 428035
Telecopy: (33-50) 428526
Telex: 385288 (NUEXCO F)

Managing Broker
James E. Vaughan

REGIONAL MANAGING BROKERS

AFRICA
James E. Vaughan

AUSTRALIA
George White, Jr.

CANADA
Wayne D. Fowler
(303) 893-4015

FAR EAST
Christian C. Guitton
(415) 854-1510

MEXICO AND SOUTH AMERICA
Earl E. Hoellen, Jr.

(See inside back cover for list of Representatives and Consultants)

NUEXCO

MONTHLY REPORT ON THE NUCLEAR FUEL MARKET

February 1986 No. 210

GEORGE WHITE, JR., *EDITOR* CLARK M. BEYER, *ASSOCIATE EDITOR*

TO OUR READERS

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To Our Readers

NUEXCO ORGANIZATIONAL ANNOUNCEMENTS

During the last several months, Nuexco has taken steps internally and externally to strengthen its organization and to increase its ability to provide services in the market it serves. Nuexco has been and intends to remain a service organization to the nuclear fuel industry. Its organizational actions are to that end.

Relocation of Headquarters Office to Denver, Colorado

The relocation of Nuexco's Headquarters to Denver, Colorado, was completed with a organization-wide meeting in December 1985. Nuexco's executive offices are located at Three Park Central, Suite 1045, where Mr. Oren L. Benton has been located for a number of years. All Nuexco personnel are located in Suite 900 at the same address. The expanded facilities and access to other personnel have permitted Nuexco to address a number of services which it has not provided in the past, while supporting and reemphasizing its brokerage, reporting and consulting services. Subscribers, customers and industry representatives are invited to stop in to meet and visit with Nuexco personnel, to see the new facilities, and are welcome to make advance arrangements to use conference rooms and communication facilities for private meetings.

Expansion of Nuexco Services

Because of its new associations and organization, Nuexco is announcing its availability to provide services in a number of areas where it has not regularly done so in the past. Nuexco will continue to provide consulting services in all areas of fuel management and market information, as well as the following new areas.

1. *Financing and Assistance in Arranging Financing.*

Nuexco may be engaged to assist companies in obtaining private financing of projects, transactions or operations. Nuexco affiliates may be involved directly or indirectly in such financing or in arranging such financing, but no equity positions in such companies will be held by Nuexco or such affiliates.

2. *Mergers and Acquisitions Assistance.*

Nuexco may be engaged to assist companies in the nuclear power industry seeking merger, acquisition or joint venture partners, and will be working with other companies who desire, or are willing, to consider investment in the nuclear power industry.

3. *Arbitration Services and Representation in Bankruptcy Proceedings.*

Nuexco may be engaged to assist in resolution of disputes by arbitration and is available to advise companies in bankruptcy proceedings. Such arbitration and representation will be performed within the normally accepted principles of independence and recognition of conflicts of interest.

4. *Escrow Agent Services.*

Nuexco may be engaged to serve as an independent escrow agent for material and cash in domestic or international nuclear fuel transactions. Independent financial institutions will serve in the custodial capacity for any assets with independent instruction from the escrow agent function.

5. *Contract Auditing and Administration.*

Nuexco may be engaged to perform independent financial or operational audits of nuclear fuel contractual arrangements between customers and to deliver reports thereon to the parties, financial institutions, etc.

6. *Testimony on Fuel Matters.*

Although previously involved in this activity, Nuexco can now offer additional experienced personnel to assist in developing nuclear fuel data and to provide testimony to support US utilities in rate-making matters before public utility commissions.

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Organization of Service Operations

Nuexco will maintain its brokerage offices in Stamford, Connecticut, the Geneva suburb of Ferney-Voltaire, France and Menlo Park, California, as in the past. The brokerage activities related to consumers previously served by the Atlanta office will be assumed by the Stamford office. Jerry Reaves will remain in Atlanta as a Consultant to Nuexco where he will work exclusively with producers and will devote special attention, on behalf of Nuexco, to companies developing new sources of US uranium production. United States brokerage operations will be headed by Earl Hoellen. European brokerage operations will continue to be headed by Jim Vaughan. Wayne Fowler, operating out of the Headquarters in Denver, will be in charge of brokerage and other service relationships in Canada. In Australia, South Africa, Taiwan, Korea, and Japan, Nuexco will continue to be represented by the same employee and representative personnel as in the past. Consulting services will be headed by Wayne Fowler in Denver, where Nuexco's extensive data base is maintained. In addition, Nuexco will continue to evaluate expansion possibilities to enhance the efficiency and professionalism of its operations and services.

Reorganization of Nuexco Structure

Nuexco has, in the past, operated in the corporate form. Effective January 1, 1986, Nuexco was reorganized as a partnership in which essentially all brokers and senior personnel became limited partners to preserve a participatory operations style. For certain regulatory and operational reasons, the form of organization and relationships may differ in some countries of Nuexco's operations. All services will continue to be provided under the name "Nuexco".

Formation of International Business Group

Nuexco has formed a group to have as its special focus Nuexco's international presence, as well as opportunities for additional or enhanced services. This group will be headed by Bob Wolcott and will initially include Mr. George Stathakis, Mr. James C.C. Stewart and Mr. Bryan Webster, the latter two having served Nuexco as consultants for several years. Other individuals of international stature will be added to the group. This group, utilizing its extensive international business experience, particularly in the nuclear power industry, will give special consideration to Nuexco's opportunities and concurrent responsibilities in international business matters. In addition, the group will make periodic reexaminations of the principles of Nuexco's international market reporting activities and its publication of the various Nuexco Values which have become industry standards. The group will be available upon request to meet with industry representatives to discuss any questions relative to Nuexco's market reporting activities.

Executive Personnel Announcements

Oren L. Benton, announced in the August 1985 Nuexco Monthly Report as having purchased Nuexco and having assumed the position of Managing Director, will continue to serve Nuexco as the Chairman of its Board of Partners. Operational responsibilities will be delegated to others. Mr. Benton will continue to devote a portion of his time to Nuexco activities but will also devote much of his time to other business interests.

Samuel R. Freeman, Vice President and General Counsel of Rio Grande Industries and its subsidiaries, will serve as Vice Chairman of Nuexco's Board of Partners. Mr. Freeman, a lawyer, has served in the past as Assistant Attorney General for Colorado, Senior Partner of the Van Cise,

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Freeman and Tooley law firm, and Chairman of the Colorado Oil and Gas Conservation Commission. He is presently a member of the Executive Committee of the Interstate Oil Compact Commission and Vice Chairman of the Industry Sector Advisory Committee on Energy for the United States Department of Commerce. Previously, he was a member of the urban Mass Transit Committee of the United States Department of Commerce. Mr. Freeman has been especially active in his company's regulatory relationships, merger and acquisition matters and, in his Colorado Oil and Gas Commission position, has heard over 1,000 cases presented for decision.

George J. Stathakis, formerly President and Chief Executive Officer of General Electric Trading Company, has affiliated with Nuexco in a Consultant capacity on International Investment Banking and will assist in several of Nuexco's service capabilities. Mr. Stathakis spent approximately 20 years in the nuclear power business with General Electric, where he became General Manager of the Atomic Power Equipment Project in 1967 and Vice President and General Manager of the Nuclear Energy Division from 1971 to 1977. Mr. Stathakis was recently appointed by President Reagan as a member of the President's Export Council and is a director of the National Foreign Trade Council, Treasurer of the Business Council for International Understanding, President of the India Chamber of Commerce of America, a director of the Atlantic Council and former chairman and presently a director of the US-Yugoslavia Economic Council.

John C. Amman, formerly Managing Partner of the Denver office of Arthur Andersen & Co., has become associated with Mr. Benton in various areas of banking and finance. Mr. Amman, a Certified Public Accountant, was active during his 25-year career with Arthur Andersen & Co. with public utility clients and their regulatory matters and with banking and financial institutions. He will spend a portion of his time working with Nuexco on consulting projects, particularly involving utility matters, as well as in connection with international financing and escrow service matters.

J. Fred Lawrence, formerly Partner in Charge of Consulting of the Denver office of Arthur Andersen & Co., has become associated with Mr. Benton in a number of business interests. Mr. Lawrence, a Certified Public Accountant and member of the Arthur Andersen firm for 21 years, has served for the past several months as Director of Operations of Nuexco and will continue to spend a portion of his time in consulting and data base administration with Nuexco, working with the Managing Brokers and Consultants.

James E. Lewis, formerly Vice President-Finance of Energy Fuels Nuclear, Inc., has become associated with Mr. Benton in a number of business interests. Mr. Lewis, a Certified Public Accountant, will spend a portion of his time serving Nuexco, particularly in consulting with customers on financing and financial arrangements, mergers and acquisitions, and financial and tax advisory matters.

French Peterson, a businessman from Houston, Texas, has been associated with Mr. Benton in various business interests. Mr. Peterson has been active in a number of investment areas, including particularly oil and gas producing and refining, telecommunications and investment advisory and management. He has been a member of the board of directors of several national organizations, and one of the companies in which he is a major shareholder, board member and active participant, manages in excess of 7 billion dollars for other financial institutions and investors. Mr. Peterson will devote a portion of his time to Nuexco matters in connection with special projects, particularly in financial matters.

Teno Roncalio, retired United States Congressman from the State of Wyoming, has been associated with Mr. Benton in various business interests. Mr. Roncalio, a lawyer, served as a member of the House of Representatives for ten years prior to 1978 and during his tenure served on the Joint Committee on Atomic Energy. Mr. Roncalio has, since his retirement from Congress, consulted with a number of energy-related producers and consumers and has served as an arbitrator in certain cases. Mr. Roncalio will devote a portion of his time to Nuexco matters in connection with special projects.

NUEXCO

PRICING

NATURAL URANIUM AND SECONDARY MARKET CONVERSION

(All data as of January 31, 1986)

The **Exchange Value** is **$17.00** per pound U_3O_8, unchanged since last month. **Active supply** of natural uranium (concentrates and UF_6) for spot or near-term delivery totals **3,940,000** pounds U_3O_8 equivalent, up 345,000 pounds since last month. The corresponding figure for **active demand** is **2,810,000** pounds, up 485,000 pounds. The spot and near-term **supply-demand ratio** declined to **1.4:1.**

The *Current Market Data* section of this Report lists five natural uranium sales and one of low-enriched uranium, involving approximately 900,000 pounds U_3O_8 in the near term and another 8 million pounds equivalent U_3O_8 in the longer term. Four of the transactions involved near-term delivery and two met the criteria for inclusion in the current Transaction Value calculation. One transaction involved natural UF_6.

The **Transaction Value** is **$16.55** per pound U_3O_8, unchanged since last month. The calculation extends over a 4-month period and includes 14 transactions involving 2.2 million pounds equivalent U_3O_8.

The **UF_6 Value** is **$47.00** per kilogram U in UF_6, unchanged since last month.

The **Conversion Value** is **$1.60** per pound U in UF_6, unchanged since last month. Active supply of secondary market conversion services for delivery within three years totals 575 thousand pounds U as UF_6. No active demand is reported. Two secondary market conversion transactions are reported, involving approximately 750 thousand pounds U as UF_6.

The **Loan Rate** is unchanged at **5 percent** per annum. One loan transaction is reported this month, involving 600 thousand to one million pounds U_3O_8.

* * *

The Exchange Value was unchanged this month due to a lack of substantial market movement. Several transactions occurred at or near the $17.00 level, and material is still available at that level for near-term delivery. Many sellers are focusing on the large number of utilities currently in the longer-term market, although small quantities continue to be sold on the spot market. Although many sellers have offered above the $17.00 level, near-term demand has not been sufficient to sustain upward price movement. Demand for deliveries within the next year to 18 months, however, continues to increase, forcing another small decline in the supply-demand ratio.

The UF_6 Value also was unchanged this month. That market remains thin, and while small amounts of UF_6 probably could be obtained for slightly less than $47.00, large amounts could possibly command as much as a dollar more. One European utility sold from its low-enriched uranium inventory through the process of a deenrichment swap, a common form of inventory liquidation.

* * *

Spot and near-term uranium prices rose steadily, if slowly, in the last three quarters of 1985, and there is a general consensus that this upward movement will continue through 1986. Accordingly, it is not surprising that a large number of utilities are focusing on filling uncontracted longer-term requirements. These requirements generally begin as early as 1987 and 1988, and extend into the mid-1990s.

Since April 1985, utilities worldwide concluded long-term contracts which will result in the delivery of more than 37 million pounds U_3O_8. Furthermore, at least thirteen additional utilities are currently evaluating proposals, awaiting responses to bid invitations, or negotiating directly with potential suppliers. These buyers are seeking more than 40 million pounds U_3O_8, most of which is for delivery prior to 1995. To the extent that these buyers are motivated by the desire to provide for long-term needs while prices are still low and the best deals still available, some are apt to be disappointed. While the lowest-cost producers have the ability to offer attractive terms in almost any market environment, they have little reason for doing so once their facilities are base-loaded or delivery commitments approach production capacity. It is important to note that just as utilities desire diversity among their uranium suppliers, producers also desire diversity among utility customers. For example, a low-cost Canadian producer, while having the ability to place *all* of its production with US buyers, could elect to allocate only 50 percent of its production to the US market because of its desire to diversify its customer base to include utilities in Europe and the Far East.

In view of the number of buyers in or about to enter the long-term market, the next several months should provide some guidance as to market direction throughout 1986. If all these requirements are to be satisfied, substantial quantities of higher-cost (and presumably higher-priced) material will have to be included. Some buyers, if disappointed in the offers received, could elect to do nothing for the present, hoping for more favorable offers at some later date. Others could pursue a "buy and hold" strategy, effectively using spot uranium to satisfy longer-term needs. This activity would probably cause spot prices to rise, increasing the relative attractiveness of currently offered long-term prices.

* * *

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PRICING

ENRICHED URANIUM AND SWUS

The **SWU Value** as of January 31, 1986, is $80 per SWU. This refers to SWU at a tails assay of 0.30 weight-percent U_{235} and for delivery within one year. Two secondary market SWU transactions are reported this month, involving approximately 200 thousand SWUs of Eurodif and DOE origin.

In the wake of these transactions, the secondary market for SWU is considerably smaller than in the last several months. Consequently, transactions are likely to be infrequent in the immediate future. Despite a limited number of market participants, the SWU prices offered vary widely, because some potential sellers have yet to make the commitment to price competitively. For the present, these sellers have chosen not to release their SWU (most of which is contained in low-enriched uranium) until higher prices are available. Since there are few buyers, that is not likely to happen soon. Those sellers having virgin SWU can command a higher price (the premium associated with virgin SWU can be as much as $10 per SWU), but again, the lack of firm demand precludes transactions at present.

In addition to price, sellers of virgin SWU and sellers of SWU contained in enriched product are differentiated by their preferred timing of sales. Usually, the virgin SWU seller prefers to sell as late as possible in the fiscal year, so that it can pay the DOE charges in September rather than earlier in the fiscal year. On the other hand, sellers holding low-enriched uranium normally prefer to sell for immediate delivery and payment.

* * *

Continuing the trend toward lower prices for primary enrichment services, DOE announced that it will sell fiscal 1987 SWU for $119 per SWU, a six dollar per SWU reduction from the current Utility Services enrichment contract (USEC) price. This represents the third consecutive year in which DOE has lowered the price of its enrichment services.

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CURRENT MARKET DATA

January 31, 1986	Market Values	Active Supply[1] (thousands)	Active Demand[1] (thousands)
EXCHANGE VALUE	**$17.00**/lb. U_3O_8	3,940	2,810
UF_6 VALUE	**$47.00**/kgU		
CONVERSION VALUE	**$1.60**/lb. U as UF_6	575	0
SWU VALUE 0.3 tails assay; delivery within one year	**$80**/SWU		
LOAN RATE	5%/annum	0	0

	$/lb. U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
TRANSACTION VALUE	**16.55**	2.2	13	4

[1] Supply and demand tables in *Current Market Data* section of this Report detail the numbers for each category.

DEFINITIONS

1. The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.
2. The **UF_6 Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.
3. The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.
4. The **SWU Value** represents Nuexco's judgment of the price at which transactions for the sale of significant quantities of SWUs of stated origin for delivery in the specified time period could be concluded as of the date indicated.
5. The **Loan Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.
6. The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
   a. Transactions closed within the previous three-month period for which delivery is scheduled within one year of the transaction date;
   b. At least ten transactions;
   c. Transactions involving a sum total of at least 2 million pounds U_3O_8 equivalent.

   The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

DERIVATIONS AND COMMENTS

1. All Market Values are based on:
   a. Data from recently completed transactions.
   b. Data from pending transactions.
   c. Firm bids to buy or borrow, and firm offers to sell or lend.
   d. Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell or lend.
2. Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these Market Values.
3. In the determination of the Conversion Value, Nuexco does not consider transportation charges other than those customarily provided by primary suppliers of conversion services.
4. The prices of conversion services or SWUs delivered under long-term contracts with primary suppliers are not considered in the determination of either the Conversion Value or SWU Value.
5. For the SWU Value, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight-percent U_{235} and a product assay of 3.0 weight-percent U_{235}, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
6. In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

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CURRENT MARKET DATA

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
	This Month (Jan 31, 1986)	Last Month (Dec 31, 1985)	12 Months Ago (Jan 31, 1985)	This Month (Jan 31, 1986)	Last Month (Dec 31, 1985)	12 Months Ago (Jan 31, 1985)
Australia (dollar)	23.74	24.92	18.38	61.71	64.78	47.78
Belgium (comm. franc)	828.06	854.70	949.37	2,153	2,222	2,468
Canada (dollar)	24.14	23.78	19.91	62.75	61.81	51.77
Finland (markka)	90.62	92.19	99.40	235.59	239.68	258.43
France (franc)	123.82	128.40	145.07	321.90	333.81	377.14
FRG (mark)	40.38	41.87	47.53	104.98	108.86	123.56
Italy (lira)	27,557	28,509	29,240	71,642	74,117	76,017
Japan (yen)	3,275	3,413	3,817	8,514	8,873	9,923
Netherlands (guilder)	45.70	47.16	53.74	118.81	122.60	139.72
South Africa (rand)	38.72	43.87	29.56	100.67	114.05	76.84
Spain (peseta)	2,548	2,621	2,628	6,625	6,815	6,832
Sweden (krona)	127.63	128.98	135.62	331.80	335.33	352.59
Switzerland (franc)	34.29	35.31	40.11	89.14	91.79	104.27
UK (pound)	12.02	11.82	13.27	31.25	30.73	34.50
US (dollar)	17.00	17.00	15.00	44.20	44.20	39.00

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
	This Month (Jan 31, 1986)	Last Month (Dec 31, 1985)	12 Months Ago (Jan 31, 1985)	This Month (Jan 31, 1986)	Last Month (Dec 31, 1985)	12 Months Ago (Jan 31, 1985)
Australia (dollar)	23.11	24.26	19.85	60.08	63.07	51.60
Belgium (comm. franc)	806.14	832.08	1,025	2,096	2,163	2,666
Canada (dollar)	23.50	23.15	21.51	61.09	60.18	55.91
Finland (markka)	88.22	89.75	107.36	229.35	233.33	279.10
France (franc)	120.54	125.00	156.67	313.37	324.97	407.31
FRG (mark)	39.31	40.76	51.33	102.20	105.98	133.45
Italy (lira)	26,828	27,754	31,579	69,746	72,155	82,098
Japan (yen)	3,188	3,323	4,122	8,289	8,638	10,717
Netherlands (guilder)	44.49	45.91	58.04	115.66	119.35	150.90
South Africa (rand)	37.70	42.71	31.92	98.01	111.04	82.99
Spain (peseta)	2,481	2,552	2,838	6,450	6,635	7,378
Sweden (krona)	124.25	125.57	146.47	323.02	326.45	380.80
Switzerland (franc)	33.38	34.37	43.32	86.78	89.36	112.61
UK (pound)	11.70	11.51	14.33	30.42	29.92	37.25
US (dollar)	16.55	16.55	16.20	43.03	43.03	42.12

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on January 31, 1986.

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CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U as UF_6			per kg. U as UF_6		
Country (currency)	**This Month (Jan 31, 1986)**	**Last Month (Dec 31, 1985)**	**12 Months Ago (Jan 31, 1985)**	**This Month (Jan 31, 1986)**	**Last Month (Dec 31, 1985)**	**12 Months Ago (Jan 31, 1985)**
Australia (dollar)	2.23	2.35	1.23	4.93	5.17	2.70
Belgium (comm. franc)	77.93	80.44	63.29	171.82	177.34	139.53
Canada (dollar)	2.27	2.24	1.33	5.01	4.93	2.93
Finland (markka)	8.53	8.68	6.63	18.80	19.13	14.61
France (franc)	11.65	12.08	9.67	25.69	26.64	21.32
FRG (mark)	3.80	3.94	3.17	8.38	8.69	6.99
Italy (lira)	2,594	2,683	1,949	5,718	5,915	4,298
Japan (yen)	308.23	321.22	254.45	679.52	708.17	560.97
Netherlands (guilder)	4.30	4.44	3.58	9.48	9.78	7.90
South Africa (rand)	3.64	4.13	1.97	8.04	9.10	4.34
Spain (peseta)	239.84	246.72	175.19	528.77	543.93	386.23
Sweden (krona)	12.01	12.14	9.04	26.48	26.76	19.93
Switzerland (franc)	3.23	3.32	2.67	7.11	7.33	5.89
UK (pound)	1.13	1.11	0.88	2.49	2.45	1.95
US (dollar)	1.60	1.60	1.00	3.53	3.53	2.20

SWU VALUE AND UF_6 VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	**SWU Value delivery within one year (January 31, 1986)**	**UF_6 Value per kg.U in UF_6 This Month (January 31, 1986)**	**UF_6 Value per kg.U in UF_6 Last Month (December 31, 1985)**
Australia (dollar)	111.70	65.62	68.89
Belgium (comm. franc)	3,897	2,289	2,363
Canada (dollar)	113.59	66.73	65.73
Finland (markka)	426.44	250.53	254.88
France (franc)	582.67	342.32	354.98
FRG (mark)	190.02	111.64	115.76
Italy (lira)	129,681	76,187	78,819
Japan (yen)	15,411	9,054	9,436
Netherlands (guilder)	215.05	126.34	130.37
South Africa (rand)	182.23	107.06	121.29
Spain (peseta)	11,992	7,045	7,247
Sweden (krona)	600.60	352.85	356.60
Switzerland (franc)	161.36	94.80	97.61
UK (pound)	56.56	33.23	32.68
US (dollar)	80.00	47.00	47.00

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on January 31, 1986.

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CURRENT MARKET DATA

RECENT TRANSACTIONS[1]

Uranium Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price as Percent of Current Exchange or UF_6 Value	Seller	Buyer	Remarks
3666A	1986	50-100	indeterminate	European Utility	European Utility	Contained in LEU.
3658	1986	50-100	98	US Producer	US Producer	
3657	1990-2000	3,001-5,000	see remarks	US Producer	US Utility	Discount off market price.
3656	1990-1994	3,001-5,000	see remarks	Canadian Producer	US Utility	UF_6. Discount off market price.
3655	1986	less than 50	100	US Producer	US Utility	
3651	1986	601-1000	R[5]	European Utility	US Producer	

Loan Transactions

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price as Percent of Current Loan Rate	Lender	Borrower	Remarks
3668	1985	601-1,000	R[5]	Utility	Producer	

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RECENT TRANSACTIONS[1] (continued)

Conversion Services
Secondary Market Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U equivalent)	Approximate Price as Percent of Current C.V.	Seller	Buyer	Remarks
3670	1986	101-300	100	European Utility	US Utility	
3669	1986	301-600	R[5]	European Utility	US Utility	

Enrichment Services
Secondary Market Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity[2] (thousands of SWUs)	Approximate Price[3] as Percent of Current SWU Value[4]	Seller	Buyer	SWU Origin	Remarks
3667	1986	101-300	R[5]	European Utility	US Utility	Eurodif and DOE	
3666B	1986	less than 50	indeterminate	European Utility	European Utility	Eurodif and DOE	Contained in LEU.

[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] If tails assay is unknown or unspecified, Nuexco's calculation of SWU quantity assumes 0.20 w/o tails assay.

[3] Price is not normalized to 0.20% tails assay.

[4] Refers to SWU Value that corresponds to SWUs included in transaction. When prices and SWU values are expressed as discounts (e.g. X dollars less than DOE's USEC base price at time of delivery), the percentage refers to the ratio of the *discounts*, not the ratio of the prices.

[5] The notation *R* means that Nuexco either does not know, or that Nuexco has restricted that information to protect client confidentiality.

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CURRENT MARKET DATA

URANIUM SUPPLY
(January 31, 1986)

	Delivery Period[1] (Thousands of Pounds U_3O_8)		
Nuexco Project Number	**Spot or Near-term[2]**	**Intermediate or Long-term**	**Remarks**
Available for Sale:			
ACTIVE			
2335*	300	—	
2680	500	500 per year	1987-92
2728	350	—	
2740*	175	—	
2793	1,000	—	
2813*	140	—	
2818*	600	—	UF_6
2851*	125	—	
3023*	750	500	UF_6
2263	—	400 per year	1987 on
2625	—	500 per year	1987 on
2778	—	220 per year	1987-90
2781	—	100 per year	1988-95
TOTAL:	3,940		
INACTIVE			
2336	250	250 per year	1986-94
2389	75	75 per year	1986-90
2654	300	700 per year	UF_6
2764	260	—	UF_6
2765	260	—	UF_6
2777	250	—	
2297	—	200 per year	1986-89
TOTAL:	1,395		

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*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 1860, 2483, 2746, 2802, 2804, 2814.

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URANIUM DEMAND
(January 31, 1986)

	Delivery Period[1] (Thousands of Pounds U_3O_8)		
Nuexco Project Number	**Spot or Near-term[2]**	**Intermediate or long-term**	**Remarks**
Inquiries to Purchase: ACTIVE			
2733	500	500 per year	1987-95
2743*	600	—	UF_6
2758	1,000	500	UF_6
2786	60	—	
2888*	650	—	
2217	—	1,000 per year	1989-95
2507	—	600	1987-89
2586	—	250 per year	1988-95
2681	—	500 per year	UF_6 or U_3O_8; 1987-88
2738	—	1,000	1989 on
2739	—	1,000 per year	1987-90
2760	—	750 per year	1986-90
2770	—	500 per year	1988-94
2782*	—	800	1987-88
2808*	—	300	1987 on
2821	—	120 per year	1988-93
2850*	—	300 per year	1990-95
2870	—	100	1989
TOTAL:	2,810		
INACTIVE			
2548	290	—	
2784*	100	—	
2798	70	—	
2806	1,000	—	
TOTAL:	1,460		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2643, 2748, 2762, 2796.

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CURRENT MARKET DATA

LOAN SUPPLY AND DEMAND
(January 31, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Within 1 Year	Beyond 1 Year	Remarks
Available for Loan:			
INACTIVE			
1938	2,000	—	UF_6
2036	500	—	
2667	800	—	
2805*	2,000	—	
TOTAL:	5,300		

*New or revised since last month.
[1] Measured from the date of this Report.
Projects removed since last month: None.

No inquiries to borrow are reported this month.

CONVERSION SUPPLY AND DEMAND
(January 31, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U as UF_6) Within 3 Years	Beyond 3 Years	Remarks
Available for Sale:			
ACTIVE			
2849	300	900	1986-90
2874*	275	—	
TOTAL:	575		
Inquiries to Purchase:			
INACTIVE			
2724	—	375	1989-93
2882*	—	1,000	1987
TOTAL:	0		

*New or revised since last month.
[1] Measured from the date of this Report.
Projects removed since last month: 2051.

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SWU SUPPLY AND DEMAND
(January 31, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of SWUs) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
2705*	125	—	
2571	—	55	
2873*	40	—	1987
2889*	25	—	
TOTAL:	190		
INACTIVE			
2410A*	340	—	
TOTAL:	340		
Inquiries to Purchase:			
INACTIVE			
2761	115	—	
2797	—	150	1988-89
TOTAL:	115		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes SWUs deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2652, 2746.

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ANALYSIS & COMMENTARY

NON-US NUCLEAR POWER PLANT BACKLOG

Construction Progress

As of January 1986, 69 units comprised the non-US nuclear power plant backlog (excluding Soviet-bloc countries). Table 1 lists those units by country in descending order of construction completion percentage. A unit enters the backlog when construction starts and exits when commercial operation begins. Thus, the backlog does not include units on which construction has not begun, such as nine units undergoing licensing in Japan. It also does not include units which have been delayed indefinitely, such as four units in Spain for which construction was terminated.

Table 1 lists the completion percentage for each unit in January 1984 and in January 1986, and uses that percentage change as a measure of progress. Table 2 then shows a breakdown of the construction progress for all of the units, placing them into a series of ten-percent ranges. The overall range of progress includes two units exhibiting at least 60 percent progress in the two-year span — Ontario Hydro's Darlington Unit 2 and Chubu Electric Power Company's Hamaoka Unit 3. Despite these remarkable achievements, thirteen units accomplished changes of less than ten percent. No units underwent negative progress.

Comparison Among Nations

Table 3 presents the current status of active nuclear power programs worldwide. The far-right column of Table 3 shows the average progress on backlog, a megawatt-weighted average of changes in completion percentages, achieved by each country. A megawatt-weighted average incorporates the varying sizes of units in a particular program, so that progress on a smaller unit is given less weight than progress on a large unit. The megawatt-weighted average progress on the entire non-US backlog was 27 percent, one percent greater than in the previous two-year span (1982-1984), and 13 percent greater than that for the USA during the same period. Next month's Report (211) will contain an analysis of the US construction backlog.

Table 3 also lists the average size of the units under construction in each country, which puts the country's progress in better perspective. For example, the United Kingdom's average progress of 31 percent for units averaging 680 MWe is not nearly as impressive as the 35 percent progress made by France, where the average unit under construction is almost twice as large.

From Table 3 it is evident that all of the nations' average construction progress fall into two groups. Nine nations achieved average progress of 25 to 35 percent. Four nations achieved average progress of less than ten percent. Table 4 takes this a step further, ranking the countries that have active construction programs involving four or more units, including the USA, according to their construction progress on backlog. For the period of January 1984 to January 1986, the nations leading the ranking were much closer to parity than in a similar analysis by Nuexco for the period 1982 to 1984 (Report 189, May 1984). The average

Table 2

**CONSTRUCTION PROGRESS
ON NON-US BACKLOG
BETWEEN JAN. 1984 AND JAN. 1986
(As measured by changes in completion percentages)**

Change in Completion Percentage[1]	Number of Units[2]
60-69	2
50-59	2
40-49	17
30-39	13
20-29	11
10-19	8
0-9	13
TOTAL	66

[1] As listed in Table 1 of this article.

[2] Excludes three units in China for which data is not available.

Table 4

**INTERNATIONAL RANKING OF
NUCLEAR POWER PLANT
CONSTRUCTION PROGRAMS[1]**

Country	Units Under Construction	Average MWe per Unit	Average Progress on Backlog[2]
France	19	1240	35
South Korea	4	916	35
Canada	7	810	34
United Kingdom	4	680	31
F.R. Germany	6	980	30
Japan	10	668	25
USA	32	1123	14
India	4	220	0

[1] Includes only those countries with four or more units currently defined as under construction.

[2] Average progress on backlog measures the average change in completion percentage for units under construction during the two-year period from January 1984 to January 1986, incorporating a MWe-weighted adjustment for differences in the size of those units. The calculation excludes units that began commercial operation during that period.

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progress for each of the top five nations now falls within a few points of 33 percent. In addition, all of these countries are progressing on their backlogs more than *twice* as rapidly as the USA, where regulatory and financing difficulties continue to prolong completion schedules.

Table 1
NON-US NUCLEAR POWER PLANT BACKLOG

Country	Unit	MWe (net)	Utility[1]	Completion Percentage Jan. 1984[2]	Completion Percentage Jan. 1986[3]	Change in Completion Percentage
Argentina	Atucha 2	692	CNEA	25	50	25
Brazil	Angra 2	1245	Furnas	10	20	10
	Angra 3	1245	Furnas	1	1	0
Canada	Pickering 8	516	Ontario Hydro	70	99	29
	Bruce 7	750	Ontario Hydro	50	99	49
	Bruce 8	750	Ontario Hydro	40	85	45
	Darlington 1	881	Ontario Hydro	0	40	40
	Darlington 2	881	Ontario Hydro	15	80	65
	Darlington 3	881	Ontario Hydro	0	10	10
	Darlington 4	881	Ontario Hydro	0	5	5
China	Quinshan	300	MNI	0	unknown	
	Guangdong 1	900	MNI	0	unknown	
	Guangdong 2	900	MNI	0	unknown	
France	Flamanville 1	1290	EDF	65	100	35
	Flamanville 2	1290	EDF	50	88	38
	St. Alban 2	1300	EDF	55	90	35
	Paluel 4	1290	EDF	55	86	31
	Cattenom 1	1265	EDF	55	85	30
	Cattenom 2	1265	EDF	40	73	33
	Chinon B3	870	EDF	35	79	44
	Chinon B4	870	EDF	25	69	44
	Belleville 1	1275	EDF	35	79	44
	Belleville 2	1275	EDF	21	67	46
	Nogent-sur-Seine 1	1275	EDF	25	67	42
	Nogent-sur-Seine 2	1275	EDF	12	52	40
	Cattenom 3	1265	EDF	1	50	49
	Cattenom 4	1265	EDF	0	30	30
	Penly 1	1290	EDF	0	45	45
	Penly 2	1290	EDF	0	18	18
	Golfech 1	1275	EDF	0	28	28
	Golfech 2	1275	EDF	0	14	14
	Chooz B1	1375	EDF	0	25	25
F.R. Germany	Kaerlich	1227	RWE	80	100	20
	Kalkar SNR 300	295	SBK	75	95	20
	Isar 2	1285	KKI	20	65	45
	Emsland	1242	VEW	0	50	50
	GKN 2	1230	GKN	5	27	22
	Brokdorf	1290	Preussenelektra	0	15	15

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Table 1 (continued)

NON-US NUCLEAR POWER PLANT BACKLOG

Country	Unit	MWe (net)	Utility[1]	Completion Percentage		Change in Completion Percentage
				Jan. 1984[2]	Jan. 1986[3]	
India	NAPP 1	220	AEC	40	40	0
	NAPP 2	220	AEC	30	30	0
	KAPP 1	220	AEC	13	13	0
	KAPP 2	220	AEC	13	13	0
Italy	Cirene	40	Enel	56	70	14
	Montalto 1	982	Enel	25	28	3
	Montalto 2	982	Enel	20	23	3
Japan	Tsuruga 2	1115	JAPC	36	92	56
	Fukushima II-4	1067	Tokyo EPC	70	90	20
	Hamaoka 3	1066	Chubu EPC	15	75	60
	Shimane 2	791	Chugoku EPC	0	35	35
	Tomari 1	579	Hokkaido EPC	0	42	42
	Tomari 2	579	Hokkaido EPC	0	3	3
	Kashiwazaki 2	1067	Tokyo EPC	0	13	13
	Kashiwazaki 5	1067	Tokyo EPC	0	19	19
	Genkai 3	1180	Kyushu EPC	0	2	2
	Genkai 4	1180	Kyushu EPC	0	1	1
S. Korea	Korea Nuclear 6	895	Kepco	76	100	24
	Korea Nuclear 7	900	Kepco	60	98	38
	Korea Nuclear 8	900	Kepco	50	90	40
	Korea Nuclear 9	943	Kepco	22	64	42
	Korea Nuclear 10	943	Kepco	20	50	30
Mexico	Laguna Verde 1	654	CFE	75	93	18
	Laguna Verde 2	654	CFE	40	42	2
Philippines	PNPP 1	620	Napocor	70	99	29
Spain	Trillo 1	997	UE/Iberduero	44	70	26
	Vandellos 2	982	Enher/HC	42	80	38
United Kingdom	Dungeness B2*	600	CEGB	100	100	0
	Torness Pt. 1	660	SSEB	50	95	45
	Torness Pt. 2	660	SSEB	35	78	43
	Heysham B1	660	CEGB	50	80	30
	Heysham B2	660	CEGB	35	70	35

*Unit entered commercial operation in 1986.

[1] See box on page 16 for list of acronyms used in this table.

[2] As listed in *Nuclear News* "World List of Nuclear Power Plants" of December 31, 1983, and other publications.

[3] As listed in *Nuclear News* "World List of Nuclear Power Plants" of December 31, 1985, and other publications.

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Table 3

ACTIVE NUCLEAR POWER PROGRAMS[1]
(Excluding Soviet-bloc Nations)

Country	Units in Commercial Operation	MWe in Commercial Operation (net)	Units Under Construction	MWe Under Construction (net)	Avg. Size of Units Under Construction	Avg. Progress on Backlog[1] (MWe-Weighted)
Argentina	2	935	1	692	692	25
Belgium	7	5,450	0	0	—	—
Brazil	1	626	2	2,490	1245	5
Canada	15	9,562	7	5,670	810	34
China	0	0	3	2,100	700	unknown
Finland	4	2,310	0	0	—	—
France	46	37,858	19	23,575	1240	35
F. R. Germany	17	16,410	6	6,569	980	30
India	6	1,244	4	880	220	0
Italy	3	1,285	3	2,004	668	3
Japan	32	23,491	10	9,691	901	25
S. Korea	4	2,685	5	4,581	916	35
Mexico	0	0	2	1,308	654	10
Netherlands	2	500	0	0	—	—
Pakistan	1	125	0	0	—	—
Philippines	0	0	1	620	620	29
South Africa	2	1,840	0	0	—	—
Spain	8	5,682	2	1,979	990	32
Sweden	12	9,435	0	0	—	—
Switzerland	5	2,890	0	0	—	—
Taiwan	6	4,884	0	0	—	—
United Kingdom	38	11,748	4	2,720	680	31
Yugoslavia	1	632	0	0	—	—
TOTAL NON-US	212	139,592	69	64,849	939	27
USA[3]	90	75,368	32	35,927	1123	14
TOTAL	302	214,960	101	100,776	998	23

[1] Not including units for which the commercial operation date is indefinite.

[2] Average progress on backlog measures the average change in completion percentage for units under construction during the two-year period from January 1984 to January 1986, incorporating an adjustment for differences in the size of those units.

[3] Nuexco will publish the US Nuclear Backlog next month in Report 211.

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Growth in Installed Capacity

Between January 1984 and January 1986, 53 units outside of the USA began commercial operation, well over twice as many as entered commercial service in the previous two-year period. The units added approximately 47,000 net MWe to world generating capacity, or about one-fifth of current free-world capacity. Table 5 lists those 53 units, along with their construction status in January 1984. Notable among these are Belgium's Doel Unit 4 and Tihange Unit 3, which were well under half-complete in January 1984, but entered commercial operation in mid-1985; also, Kyushu Electric Power Company's Sendai Unit 2, which was 50 percent complete in January !984 and began commercial operation in late 1985. Interestingly, all six of the Central Electricity Generating Board (CEGB) units that came on line during the period were 100-percent complete in January 1984.

Of the 69 units in the current backlog, a number are near the commercial stage. Table 6 provides a breakdown of completion percentages of units in the non-US backlog, and illustrates that 30 percent of these units are between 80 and 100-percent complete, and well over half of the units are 50-percent complete or more. This data suggests that non-US nuclear capacity will continue to grow significantly within the next several years.

Table 6

COMPLETION PERCENTAGES OF UNITS IN NON-US BACKLOG

Percent Complete[1]	Number of Units[2]
90-100	13
80-89	7
70-79	8
60-69	5
50-59	5
40-49	5
30-39	3
20-29	6
10-19	8
0-9	6
TOTAL	66

[1] As listed in Table 1 of this article.

[2] Excludes one unit listed in Table 1 that has begun commercial operation during 1986, and three units in China for which data is not available.

Acronyms Used in Tables 1 and 5

AEC = Atomic Energy Commission (India)
CEGB = Central Electricity Generating Board
CFE = Comision Federal de Electricidad
CNEA = Comision Nacional de Energia Atomica
Ebes = Societes Reunies d'Energie du Bassin
EDF = Electricité de France
Enel = Ente Nationale per l'Energia Elettrica
Enher = Empresa Nacional Hidroelectrica Ribagorzana
EPC = Electric Power Company
Escom = Electricity Supply Commission
EVS = Energie Versorgung Schwaben
Fecsa = Fuerzas Electricas de Cataluna S.A.
GKN = Gemeinschaftkernkraftwerk Neckar
HC = Hidroelectrica de Cataluna SA
HEW = Hamburgische Elektricitaetswerke
Hidrola = Hidroelectrica Española S.A.
HKG = Hochtemperatur-Kernkraftwerk GmbH
Intercom = Société Intercommunale Belge de Gaz et d'Electricité
JAPC = Japan Atomic Power Company
Kepco = Korea Electric Power Corporation
KKI = Kernkraftwerk Isar
KKL = Kernkraftwerk Leibstadt AG
MNI = Ministry of Nuclear Industry (China)
Napocor = Philippine National Power Corporation
Nersa = Centrale Nucléaire Européene a Neutrons Rapides S.A.
OKG = Oskarshamnsverkets Kraftgrupp Aktiebolag
PNC = Power Reactor and Nuclear Fuel Company
RWE = Rheinisch-Westfalisches Elektrizitaetswerk
SBK = Schnell-Bruter-Kernkraftwerksgesellschaft
SSEB = South of Scotland Electricity Board
SSPB = Swedish State Power Board
UE = Union Electrica
VEW = Vereinigte Elektrizitaetswerke Westfalen

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Table 5

UNITS THAT BEGAN COMMERCIAL OPERATION BETWEEN JAN. 1984 AND JAN. 1986

Country	Unit	Net MWe	Lead Utility[1]	Percent Complete Jan. 1984[2]	Commercial Operation Date
Belgium	Doel 4	1000	Ebes	40	Jul 1985
	Tihange 3	1000	Intercom	30	Sep 1985
Brazil	Angra 1	626	Furnas	100	Dec 1984
Canada	Pickering 6	516	Ontario Hydro	100	Feb 1984
	Bruce 6	795	Ontario Hydro	80	Sep 1984
	Pickering 7	516	Ontario Hydro	80	Jan 1985
	Bruce 5	795	Ontario Hydro	70	Mar 1985
France	Chinon B1	870	EDF	100	Feb 1984
	Cruas 1	880	EDF	100	Apr 1984
	Chinon B2	870	EDF	100	Aug 1984
	Cruas 3	880	EDF	98	Sep 1984
	Gravelines C5	910	EDF	85	Jan 1985
	Cruas 4	880	EDF	85	Feb 1985
	Cruas 2	880	EDF	98	Apr 1985
	Gravelines C6	910	EDF	70	Nov 1985
	Paluel 1	1290	EDF	100	Dec 1985
	Paluel 2	1290	EDF	95	Dec 1985
	St Alban 1	1300	EDF	70	Dec 1985
	Paluel 3	1290	EDF	70	Dec 1985
	Creys-Malville	1200	Nersa	85	Jan 1986
F.R. Germany	Kreummel	1260	HEW	100	Mar 1984
	Gundremmingen 2	1244	RWE	100	Jul 1984
	Gundremmingen 3	1244	RWE	80	Jan 1985
	Grohnde	1300	Preussenelektra	85	Feb 1985
	Philippsburg 2	1268	Badenwerk/EVS	95	Apr 1985
	THTR 300	296	HKG	85	Jul 1985
India	MAPP 1	220	AEC	100	Jan 1984
	MAPP 2	220	AEC	88	Oct 1985

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Table 5 (continued)

UNITS THAT BEGAN COMMERCIAL OPERATION BETWEEN JAN. 1984 AND JAN. 1986

Country	Unit	Net MWe	Lead Utility[1]	Percent Complete Jan. 1984[2]	Commercial Operation Date
Japan	Fukushima II-2	1067	Tokyo EPC	100	Feb 1984
	Onagawa 1	497	Tohoku EPC	100	Jun 1984
	Sendai 1	846	Kyushu EPC	100	Jul 1984
	Takahama 3	830	Kansai EPC	92	Jan 1985
	Takahama 4	830	Kansai EPC	75	Jun 1985
	Fukushima II-3	1067	Tokyo EPC	85	Jul 1985
	Kashiwazaki 1	1067	Tokyo EPC	85	Sep 1985
	Sendai 2	846	Kyushu EPC	50	Nov 1985
S. Korea	Korea Nuclear 5	895	Kepco	90	Sep 1985
South Africa	Koeberg 1	922	Escom	100	Jul 1984
	Koeberg 2	922	Escom	96	Nov 1985
Spain	Asco 1	887	Fecsa/Enher	100	Dec 1984
	Cofrentes	975	Hidrola	98	Mar 1985
	Asco 2	887	Fecsa/Enher	98	Jun 1985
Sweden	Forsmark 3	1050	SSPB	75	Aug 1985
	Oskarashamn 3	1050	OKG	65	Aug 1985
Switzerland	Leibstadt	950	KKL	100	Dec 1984
Taiwan	Maanshan 1	890	Taiwan Power	94	Jul 1984
	Maanshan 2	890	Taiwan Power	78	May 1985
United Kingdom	Dungeness B1	600	CEGB	100	Mar 1984
	Hartlepool R1	625	CEGB	100	May 1984
	Heysham A1	625	CEGB	100	May 1984
	Hartlepool R2	625	CEGB	100	Feb 1985
	Heysham A2	625	CEGB	100	Feb 1985
	Dungeness B2	600	CEGB	100	Jan 1986

[1] See box on page 16 for list of acronyms used in this table.

[2] As listed in the *Nuclear News* "World List of Nuclear Power Plants" of December 31, 1983.

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EUROPE

Superphénix, the 1,200-MWe liquid-sodium Fast Breeder Reactor (FBR) was connected to the French electricity grid on January 14, 1986, an impressive achievement for the European consortium building this unit. The unit is twice the size of the Soviet BN-600 FBR (Table 7), and is the only FBR in the world having a capacity comparable to the world's largest light-water reactors (LWR). The unit should reach full power within the next few months. Superphénix is located on the Rhone River 50 kilometers east of Lyon, France. It is owned by NERSA (Centrale Nucléaire Européene a Neutrons Rapides SA), of which EDF (Electricité de France) owns 51 percent, the Italian state utility ENEL (Ente Nationale per l'Energia Elettrica) owns 33 percent, and SBK (Schnell-Breuter Kernkraftwerksgesellschaft) mbH), the North European utility consortium formed to build the Kalkar FBR, owns 16 percent. Power from Superphénix will be distributed at cost to the owners.

The cost of building Superphénix was more than twice that of a standard French 1,200-MWe thermal reactor. One reason for the comparatively high cost is that the FBR, unlike a contemporary French LWR, is not standardized and mass-produced. Even if it were replicated *en masse,* however, the FBR would still be more expensive, primarily because of the design complexities associated with the sodium circuit, the control of the reactor, and the fuel construction. The fuel core of Superphénix contains approximately 4.7 metric tons (MT) plutonium (Pu), along with some 30 MTU as natural uranium; the outlying fuel bed is composed of natural UO_2.

Over the life of the FBR, reprocessing of fuel will yield more Pu than is burned in the unit itself. Theoretically, in a "breeder economy," which visualizes a network of fast reactors using Pu as their principal fuel, the production of fuel by an FBR compensates for the unit's high cost. The attractiveness of the breeder economy is determined by the cost of uranium fuel for thermal reactors. If natural uranium is scarce and expensive, the FBR may be economically attractive. If, as is now the case, uranium is cheap and plentiful, the FBR holds no economic advantage over the LWR.

Thus, while Superphénix is an important technical achievement and a tribute to European cooperation in nuclear energy development, it is also a symbol of past expectations. Until the mid-1970s, when both NERSA and SBK were formed to pool the resources of countries in the European Community for the development of FBRs, the fast reactor offered a solution to the anticipated problem of uranium scarcity. Since that time the commercial lure of the FBR has disappeared. Declines in electricity demand growth and gluts in the uranium and oil markets have led utilities to restructure their economic priorities. The US government abandoned the Clinch River FBR project three years ago because the economics of the project no longer seemed favorable. Japan's Monju FBR, originally scheduled for operation this year, is still in the planning stage.

Table 7

COMMERCIAL FAST BREEDER REACTORS

Owner/Operator	Unit	Location	MWe	Commercial Operation Date
USSR	BN-350	USSR	350	1973
EDF[1]	Phénix	France	233	Dec 1973
UKAEA[2]	Dounreay	UK	250	Aug 1976
USSR	BN-600	USSR	600	Oct 1980
NERSA[3]	Superphénix	France	1200	Jan 1986
SBK[4]	Kalkar*	FRG	295	Jan 1987
PNC[5]	Monju**	Japan	280	indefinite

*Under construction

**Planned

[1] EDF = Electricité de France.

[2] UKAEA = United Kingdom Atomic Energy Authority.

[3] NERSA = Centrale Nucléaire Européene a Neutrons Rapides SA.

[4] SBK = Schnell-Breuter Kernkraftwerksgesellschaft mbH.
Rheinisches-Westfaelisches Elektrizitaetswerk AG (RWE) owns 68.75 percent, the Dutch utility group SEP and Belgium's Electronucleaire own 14.75 percent each, and Britain's CEGB owns 1.75 percent.

[5] PNC = Power Reactor and Nuclear Fuel Development Corporation (Japan).

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FRANCE

Effective January 1, 1986, some of the uranium holdings of the large energy and mining group Total have been reorganized. Compagnie Minière Dong Trieu (CMDT) and Société Centrale de l'Uranium et des Minérais et Métaux Radioactifs (SCUMRA) have been merged into Total Compagnie Minière France (TCMF). TCMF is owned by Total Compagnie Minière (99 percent) and Total Compagnie Francaise des Pétroles (1 percent).

Figure 1 shows the revised ownership structure for uranium holdings of the Total group. Prior to the merger, CMDT owned and operated the Bernardan and Loges mines in Mailhac, and SCUMRA produced uranium at the open-pit mine at Saint-Pierre du Cantal, which was shut down in June 1985. Other wholly-owned subsidiaries of Total Compagnie Minière include Total Mining Australia Pty. Ltd., which owns the undeveloped Ben Lomond project in northern Queensland, and Minatome Corporation in the USA. In addition, Total owns ten percent of the Rossing project in Namibia, the world's largest open-pit uranium mine.

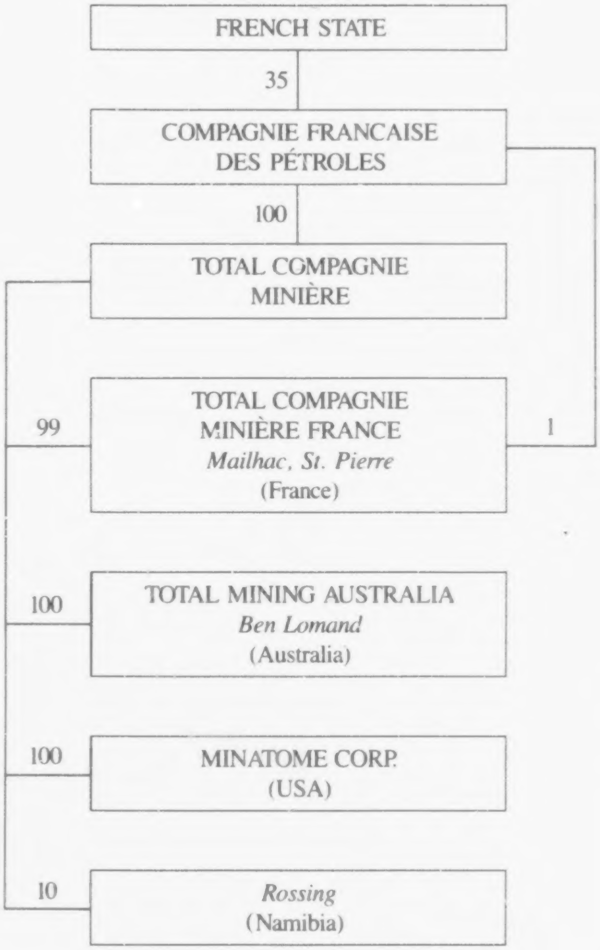

Figure 1. Ownership Structure of Uranium Holdings in the Total Group.

JAPAN

The Japanese utilities recently announced 1985 performance results for their 32 commercial nuclear units, which represent a total of 24,521 MWe net generating capacity. The 32 units accounted for approximately 24 percent of Japan's commercially produced electricity in 1985. Comprised of 16 BWRs, 15 PWRs, and one gas-cooled reactor, Japan's nuclear program achieved an average availability factor of 75.6 percent and an average capacity factor of 74.2 percent. The results established new records, and 1985 was the fourth year in a row that these factors have exceeded 70 percent. The results include five units which entered commercial operation last year and operated for only part of 1985. Table 8 lists these reactors.

For the last five years the Japanese utilities, in cooperation with various domestic reactor manufacturers, have performed conceptual studies for the design of a new generation of BWR and PWR facilities. Designated as *ABWR* and *APWR* (for *advanced* BWR and PWR), the new types of plants have capacities of approximately 1,300 MWe, a significant increase over the current maximum size of 1,100 to 1,200 MWe. Tokyo Electric Power Company (TEPCO) has indicated it will probably adopt the new ABWR design for Kashiwazaki Units 6 and 7, scheduled to be in operation after 1995. Concurrently, the Ministry of International Trade and Industry (MITI), in cooperation with the utilities and reactor manufacturers, has initiated a study to evaluate yet another generation of plant designs that will follow the ABWR and APWR. The study will review the feasibility of plant sizes approaching 1,500 MWe, and in 1987 will begin executing conceptual designs. The emphasis on larger-capacity plants stems not only from the economy of scale of larger plants, but also from the desire to maximize utilization of the limited number of plant sites available in Japan.

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Recently the US Department of Energy (DOE), the predominant supplier of enrichment services to Japanese utilities, approached its Japanese clients to solicit financial support for DOE's AVLIS laser enrichment program. In September 1985, DOE first solicited support from the Japanese government for the program (see Report 207, November 1985). In response to the request, the utilities in December 1985 formed a study group led by senior members of their respective nuclear departments to evaluate DOE's request. At the government-level meetings, DOE had suggested Japan contribute $2 billion to DOE's program, and subsequent credits would be granted to the utilities for future enrichment service charges based on interest on the contributed sum. In subsequent discussions with the utilities, DOE further proposed an increase in the total quantity of enrichment services it would supply to Japan under existing Utility Services enrichment contracts (USEC) held by the utilities, in particular those that had elected to take 70 percent of their requirements under the USEC.

Although the utilities appeared agreeable to contributing some degree of financial support to the AVLIS program, DOE's proposal to increase services delivered under the USEC has created considerable consternation among utilities. At present, the utilities are proceeding with plans to build and operate their own domestic enrichment facility, having an annual capacity of 1.5 million SWU by the mid-1990s (Report 206, July 1985). The DOE request to increase SWU quantities is viewed as unreasonable, and is a disturbing sign to the domestic enrichment program. Subsequently the government agency protested to DOE that the proposed additional SWUs contradicted the initial discussions which occurred at the government level. Discussions between the utilities and DOE are continuing. Assuming some modification to DOE's proposal, in particular that part related to supply of additional enrichment, it is expected that Japanese utilities will ultimately provide significant financial support for the DOE program, although perhaps less than the suggested sum.

* * *

The Uranium Resources Development Committee (URDC) of Japan indicated it will initiate a joint feasibility study with the People's Republic of China for the mining of uranium reserves at Chinglong in China. URDC is an organization sponsored by the Japanese government and staffed by personnel from nuclear utilities and related companies. Chinese agencies have supplied URDC with preliminary geological data for purposes of evaluation. If the study proceeds, a detailed site evaluation will be made over a two-year period to confirm reserves and to plan its development. No information regarding the size or nature of the deposit was released, although the possibility of starting to mine as soon as 1991 was mentioned.

If the project proves viable, Japanese participants would be allocated a portion of production beginning in 1995. It is estimated that current US dollar production cost would be less than $20 per pound U_3O_8. To minimize initial investment, manual production methods may be utilized instead of a highly mechanized operation.

Table 8

UNITS ENTERING COMMERICAL OPERATION IN 1985

Unit	Utility	MWe	Type	COD[1]
Takahama 3	Kansai EPC[2]	870	PWR	Jan 1985
Takahama 4	Kansai EPC	870	PWR	Jun 1985
Fukushima II-3	Tokyo EPC	1100	BWR	Jun 1985
Kashiwazaki 1	Tokyo EPC	1100	BWR	Sep 1985
Sendai 2	Kyushu FPC	890	PWR	Nov 1985

[1] COD = Commercial Operation Date.

[2] EPC = Electric Power Company.

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SOUTH AFRICA

Fourth quarter uranium production from members of the Chamber of Mines totaled 3,102,000 pounds U_3O_8, almost equalling third-quarter production. Table 9 shows the quarterly production figures for 1985.

Total production of 12.2 million pounds U_3O_8 in 1985 represents a 15-percent decline from the 1984 level of 14.5 million pounds. The chief reason for this drop was the cessation of operations at Beisa and Blyvooruitzicht at the end of 1984. Beisa, which had been producing approximately one million pounds annually, was shut down because of sharply increasing losses. Being a primary uranium producer with gold as a by-product, the mine was unable to rely on gold operations to remain profitable. Blyvooruitzicht, a relatively high-cost producer, ceased uranium production in November 1984.

Other factors contributing to the decline in 1985 production include the following:

1. Western Deep Levels ceased production during the second quarter of 1985, so there was no output in the third or fourth quarters. However, sales from its stockpile continued during that period.

2. Production at Driefontein Consolidated fell 45.7 percent, mostly due to decreased throughput and yield.

3. Production fell 48.5 percent at Chemwes (Stilfontein), whose officials announced in March 1985 a provisional reduction of 60 percent of capacity due to reduced current demand.

4. Harmony and Vaal Reefs each recorded small declines in 1985.

The South African uranium industry has now shut down its unprofitable plants and has curtailed production so that it matches current contract commitments. The gold and uranium operations remain highly viable due to record rand gold prices. Domestic political unrest and international concern caused a dramatic decline in the value of the rand relative to other currencies throughout 1985, but because most South African uranium contracts are priced in US dollars, the weaker rand helped to alleviate the downward pressure on US dollar-denominated uranium prices.

Table 9

**REPUBLIC OF SOUTH AFRICA:
1985 URANIUM PRODUCTION[1]
(Thousands of Pounds U_3O_8)**

Operation	First Quarter 1985	Second Quarter 1985	Third Quarter 1985	Fourth Quarter 1985	Total 1985
Beisa (St. Helena)	0	0	0	0	0
Blyvooruitzicht	0	0	0	0	0
Buffelsfontein	401	378	366	428	1,573
Chemwes (Stilfontein)	148	148	160	139	595
Driefontein Consolidated	45	47	51	48	191
ERGO[2]	83	76	92	95	157
Harmony	256	225	225	234	940
Hartebeestfontein	239	222	243	240	944
JMS[3]	314	356	348	310	1,328
Randfontein	291	319	363	371	1,343
Vaal Reefs	1,156	799	1,137	1,059	4,151
Western Areas	150	189	171	178	687
Western Deep Levels	62	57	0	0	119
TOTAL[4]	3,145	2,816	3,154	3,102	12,218

[1] Excludes Palabora Mining Company, which is not a member of the Chamber of Mines.

[2] ERGO = East Rand Gold and Uranium Co. Ltd.

[3] JMS = Free State Joint Metallurgical Scheme.

[4] Columns may not add due to rounding.

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1985 US URANIUM ACTIVITIES

Introduction

The decline of activity in all phases of the uranium industry continued through its fifth consecutive year. The price of uranium, as measured by the Nuexco Exchange Value, rose to $17.00 by the end of 1985, the first steadily upward movement in 15 months. Active and potential producers are still waiting for higher market prices and industry stability. Nevertheless, only a rapid and sizeable market recovery will end the debate over the industry's viability.

The year began with the Exchange Value at $15.25 per pound U_3O_8. Because of several inventory liquidations in an already weak market, it fell to $14.25 in April, the lowest figure ever recorded in Exchange Value history. That decline acted as a trigger for further producer recession; several companies responded almost immediately by relegating their projects to standby or shut-down status. By the end of the year, exploration and mining levels had fallen below those in 1950.

Nuexco estimates production from all sources in 1985 to be approximately 11.1 million pounds U_3O_8, down from 15.6 million pounds in 1984. Nine conventional mills were in production during January, but only three operated throughout the year; the other six mills were taken out of service before mid-year. Two mills were started-up in the fourth quarter, one of which was again placed on stand-by at the end of the year. Approximately six million pounds U_3O_8 were produced at conventional mills, about 3.3 million pounds were produced from phosphate production, and the remaining concentrates came from solution and heap-leach mining. Table 10 gives the operating status of conventional mills throughout 1985.

Project Activity

Nuexco estimates 1985 exploration and development drilling to be 1.8 to 2.0 million feet, the lowest level since 1950. The surface drilling rate has now declined for the seventh consecutive year (the all-time high was 47 million feet drilled in 1978). Exploration geologists were active primarily in northern Arizona, but also carried out some limited work in the following areas:

— Live Oak, Duval and Kleberg counties of the South Texas district;

— northwestern Nebraska;

— three Tertiary basins in Wyoming, and

— southeastern Utah.

Success was primarily limited to significant high-grade mineralization discovered in breccia pipes located in northern Arizona. Discoveries in other areas were mostly confined to extensions of known deposits and projections along mineral and structural trends. These discoveries generally have a lower uranium content, but are important in sustaining industry activity in the particular area.

Arizona — The past exploration successes in northern Arizona resulted from extraordinary effort on the part of active companies. At present there are at least four major mining companies, plus approximately 16 small companies and independent operators, exploring in the district. Each employs its own techniques to discover uranium associated with solution-collapse structures in Permian and Mississippian sediments.

Table 10

1985 OPERATING STATUS OF CONVENTIONAL URANIUM MILLS IN THE USA
(O = Operating, S = Stand-by)

Company	Jan.	Jul.	Dec.	Location
Bear Creek Project	O	O	O	Powder River Basin, WY
Chevron Resources Co.	O	S	S	Hobson, TX
Cotter Corp.	O	S	O	Canon City, CO
Homestake Mining Co.	O	S	S	Grants, NM
Pathfinder Mines*	O	S	S	Gas Hills, WY
Pathfinder Mines	O	O	O	Shirley Basin, WY
Petrotomics Corp.**	O	S	S	Shirley Basin, WY
Quivira Mining Co.	O	S	S	Grants, NM
Rio Algom Corp.	O	O	O	La Sal, UT
Union Carbide & Energy Fuels	S	S	O	Blanding, UT

*Closed for renovation.
**Decommissioned in 1985.

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Not all of the companies have enjoyed exploration success; in fact, only Energy Fuels Nuclear, Inc. has announced recent discoveries. Pathfinder Mines Corporation and Rocky Mountain Energy Company have aggressive exploration programs which may have resulted in limited success, although neither company has made an announcement to that effect. Usually a new discovery remains unannounced to allow time for the company to solidify its land position within the area of interest.

The geologic development of a breccia pipe in the Grand Canyon district is believed to be related to the simultaneous occurrence of regional structural events in addition to erosional patterns established by the Colorado River drainage system. Indeed, there is surface evidence that thousands of beccia pipes may exist within the large area of interest. The area covers approximately 8.25 million acres (about 12,800 square miles) — from the Utah/Arizona state line to the north, Marble Canyon to the east, Grand Wash Cliffs to the west, and the approximate mid-point between Flagstaff and Grand Canyon to the south. However, about five million acres are withdrawn from mineral entry because of national and recreational parks and portions of three Indian reservations. Of the remaining 3.25 million acres, about 300,000 acres are covered by a thick basalt flow and is not feasible for prospecting by present means. The remaining 1.7 to 1.8 million acres are available for prospecting; four major companies control approximately 1.2 million acres, and the independents control about 30,000 acres. Roughly 500,000 acres of land remains available for prospecting. Figure 2 shows the geographic location of the general area of interest and the location of known mineralized breccia pipes.

Energy Fuels, with about 900,000 acres, controls the largest land position in the district; Rocky Mountain Energy controls about 180,000 acres, Pathfinder Mines controls approximately 90,000 acres, and Uranerz Exploration and Mining Ltd. controls about 15,000 acres. Land status within the area of interest is mostly Public Domain, with scattered State leases in the north portion. Ownership is divided roughly between private, State, Indian and Public Domain in the south portion. Prospecting rights are secured on Public Domain by staking a lode mining claim which can legally include up to 20 acres per claim, and by securing a lease or permit for prospecting and mining the remaining land from the land owner.

Interest in the district was renewed in 1974 when Western Nuclear Inc. made two high-grade discoveries in the vicinity of Hack Canyon, site of a copper/uranium discovery in the early 1950s. Western Nuclear discovered the Hack 1 deposit in 1974 and the Hack 2 deposit in 1975. Energy Fuels began staking claims in the district and initiated drilling in 1980. Soon thereafter, Energy Fuels purchased the Hack 1 and 2 mines and surrounding claims from Western Nuclear.

Energy Fuels proceeded to develop the Hack 1, 2, and 3 mines, the Pigeon mine, and is presently developing a fifth mine on the Kanab North deposit. The Hack 1 mine has been on standby status since 1984. The permitting process for the Pinenut ore body, discovered in June 1985, is scheduled to be completed by mid-1986; shaft development may begin by the end of the year. All of these deposits are located to the north of the Colorado River. An Environmental Impact Study for the Canyon deposit, located south of the river, is presently in final review. Mine permit applications are awaiting final approval by various state and federal agencies. Initial shaft construction could begin in the second half of 1986.

The discoveries made by Energy Fuels can be credited to sophisticated exploration techniques developed since 1980. The exploration department conducts detailed studies of aerial photographs to select potential areas of interest showing one or more circular structures. The structures are then examined on the ground to determine the mineralization. Evaluation studies include geologic mapping, sampling of surface rocks, and detailed on-site geochemical and geophysical studies.

In cases where results may indicate the presence of a mineralized structure, reconnaissance drilling is initiated, both inside and outside the limits of the structure. Each hole is usually core-drilled from top to bottom of the potential mineralized zone in each structure. Usually, only two to four drill holes are required to determine whether the structure is mineralized. When mineralization is encountered, 15 to 25 drill holes may be required to establish the nature of mineralization and determine the potential size of the deposit. However, due to the structural and stratigraphic nature of a breccia pipe, it is extremely difficult and geologically risky to attempt a complete evaluation of a deposit by surface drilling alone. It is necessary to sink a shaft outside the influence of the structure and drift laterally into strategic sections of the mineralized zone. Follow-up long-hole drilling, usually in a radial pattern above and below the drift level, is required at measured intervals along the length of each drift. A final estimate of ore body size and grade can be tabulated from combined results of surface drilling and underground drifting and drilling. For example, the results of surface drilling of the Pigeon deposit indicated the presence of 2.5 million pounds U_3O_8. Underground exploration drifting and long-hole drilling increased total reserves to almost six million pounds. Each mineralized pipe discovered to date has a similar history in determining the size and grade of the deposit.

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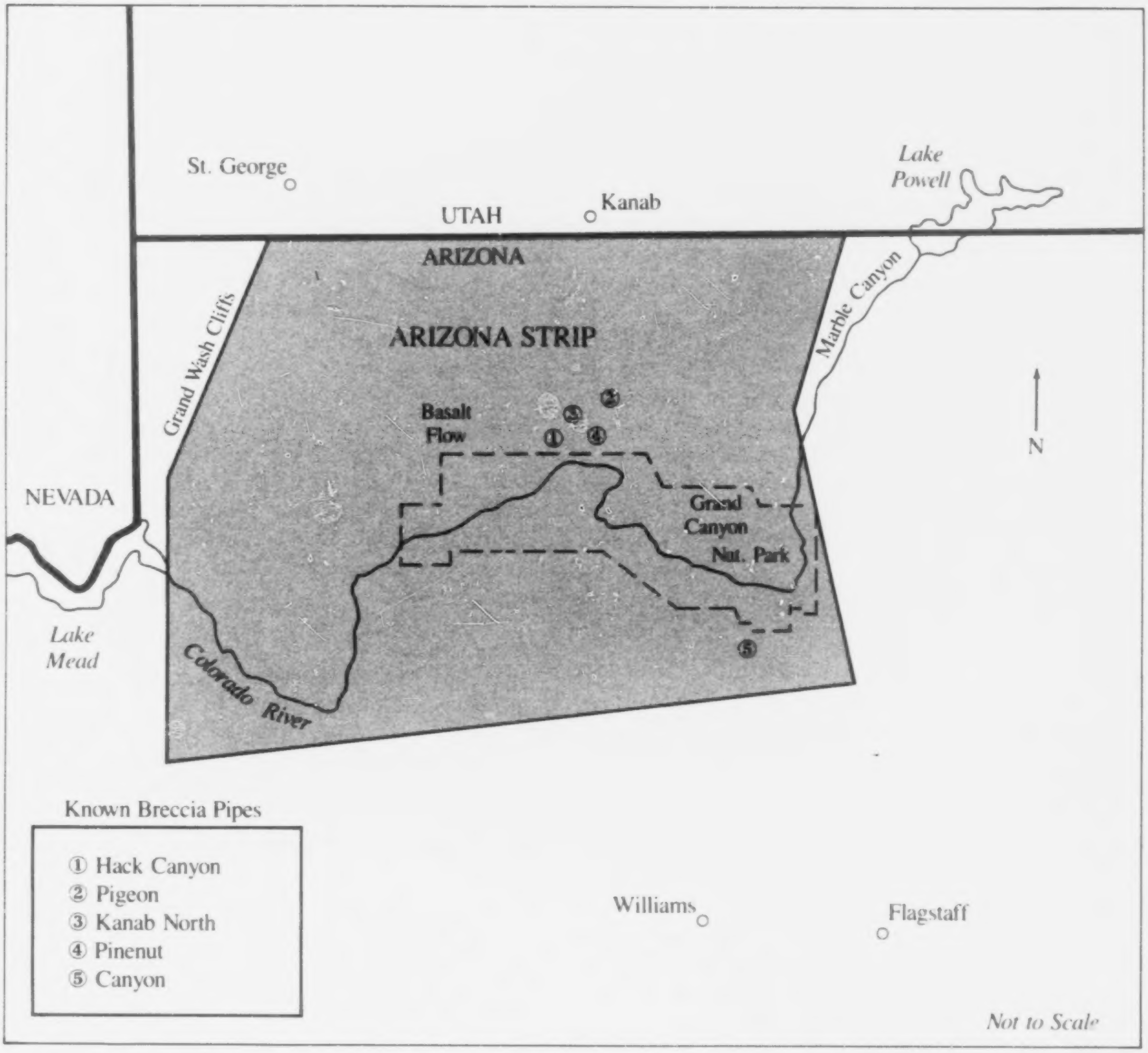
St. George
Lake Powell
UTAH
Kanab
ARIZONA
ARIZONA STRIP
Grand Wash Cliffs
Marble Canyon
Basalt Flow
①
②
③
④
⑤
N
NEVADA
Grand Canyon Nat. Park
Lake Mead
Colorado River
Known Breccia Pipes
① Hack Canyon
② Pigeon
③ Kanab North
④ Pinenut
⑤ Canyon
Williams
Flagstaff
Not to Scale

Figure 2. Shaded area indicates general area of interest for exploration and mining of breccia pipe structures in the Grand Canyon region of northwestern Arizona.

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Energy Fuels has identified over 3,000 circular structures through its preliminary evaluation process since 1980. About 1,000 structures have been studied in limited detail, but only 280 have received complete geologic evaluation, including reconnaissance drilling. A total of 490 deep holes have been drilled to date; mineralization was encountered in one out of every three holes drilled. The exploration department is scheduled to transfer at least one ore deposit each year to the mining department.

Texas — Approximately five companies conducted new exploration projects in the South Texas district in 1985. Drilling was concentrated on targets in the Goliad Formation, where past experience indicates the greatest potential for large, high-grade deposits. In addition, Goliad ores have proven conducive to solution mining techniques. Favorable Goliad mineral trends are being explored in Duval, Brooks and Kleberg counties. Activity continues along the known trends in the Oakville Sandstone, primarily in Live Oak and Bee counties, but to a lesser degree. No announcements of important new discoveries have been made.

Mining activity throughout the district is at its lowest level in about seven years. Chevron Minerals Corporation stopped mining the district's only conventional open pit mines and acid mill and began pit reclamation in April. Milling operations ended in June. Chevron controls additional reserves in the general vicinity of the mill site. It is probable that the future status of the mill is dependent upon a tentative development schedule of those reserves.

There are five operating solution mines in the district, down from ten in 1982:

1. Mobil Corp., mining the Holiday-O'Hearn deposit near Bruni;

2. Intercontinental Energy Corp. (IEC), mining the Zamzow deposit at Three Rivers;

3. US Steel Corp., mining both the Clay West and Burns Ranch deposits near George West;

4. Everest Minerals Corp., mining the Mt. Lucas deposit, in southern Live Oak County;

5. Chevron Resources Corp., mining the Palangana Dome in Duval County. Production potential from the five properties is about 3.8 million pounds annually, but 1985 production totaled an estimated 1.8 million pounds. US Steel remains the largest single producer in the district.

Nebraska — Exploration activity was limited to three or four companies, all active in Dawes and Box Butte counties in the northwest corner of the state. No new discoveries were announced. Therefore, the Crow Butte project, controlled by the Wyoming Fuels Co./Ferret Exploration Co. joint venture, remains the only uranium deposit under consideration for development within the state.

A pilot plant for testing the feasibility of solution mining is under construction at Crow Butte. The 100 gallon-per-minute plant is scheduled to be operating by mid-1986. Two 5-spot well patterns are in place and ready for operation to determine favorable well pattern design and complete leach technology. The leach test program will continue for approximately 12 months, followed by an additional four to six months testing to demonstrate formation restoration procedures. Upon completion of a successful pilot test, the joint venture will be capable of commercial production.

Wyoming — Exploration and development activities were limited to the Powder River Basin, Gas Hills and Shirley Basin. In the Powder River Basin, Everest Minerals Corp. continues to test portions of the Highland ore deposit for solution mining in anticipation of moving up in the near future to commercial production. The Central Electricity Generating Board (CEGB) of Great Britain purchased the Leuenberger property, located in the southern part of the basin, in August. The property is a potential in-situ leach (ISL) project, and required mining permits are already in place as a result of a successful pilot test program conducted in 1983.

Malapai Resources acquired the remaining 50 percent interest in the Christensen Ranch property from Western Nuclear, Inc., and secured a two-year option to purchase the Irigaray property and ISL plant from Westinghouse. Preparations are in progress to initiate solution mining studies on both properties, possibly beginning in mid-1986. Furthermore, Malapai has tentatively scheduled commercial production from at least one of several potential ore deposits on the properties in late 1987 or early 1988. At present the only sustained production in the Powder River Basin is from two small solution mining operations by Sequoyah Fuels Corp. The recovery centers are part of the Bill Smith property, which was originally developed as an underground mine in the late 1970s.

Pathfinder Mines is the only operator in the Gas Hills and Shirley Basin regions. In March, the Gas Hills mill was closed for renovation prior to the continuation of mining at the Lucky Mc mine and any new projects that may be scheduled for future development. In December, Pathfinder also acquired a property controlled by Petrotomics, suggesting that an additional ore source will be available to sustain operations at the Shirley Basin mill.

Utah — The October 1 reopening of the Union Carbide/Energy Fuels White Mesa mill located near Blanding was the high point of activity in southeastern Utah. The mill is processing stockpiled ore from Energy Fuels' three Hack Canyon mines and the Pigeon mine. Additional ore is trucked from the mines in northern Arizona to the mill, a distance of over 300 miles. The mill is scheduled to continue operation through 1986.

The Rio Algom mill in La Sal, Utah continued operation throughout the year. In order to increase the ore supply, Rio Algom purchased custom ore from independent miners. The opportunity to sell ore slightly rejuvenated the local industry; seven mines were reopened and new project evaluation was undertaken in some cases. Rio Algom is now scheduling operations throughout 1986.

In the same district, Minatome Corp. satisfied annual assessment requirements by driving exploration adits into several ore deposits to establish ore body characteristics and obtain bulk samples for metallurgical testing. The ore deposits are now ready for mining should Minatome decide to move ahead with its uranium program. The several hundred tons of ore mined were processed at the nearby Rio Algom mill.

Events that further affected the US uranium industry in 1985 are listed chronologically in Table 11.

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Table 11
1985 URANIUM-RELATED ACTIVITIES IN THE USA

Month	Organization	Event or Announcement
Jan	Quivira Mining Co.	Announced full stand-by status for all mines and mill within next few months, Grants, New Mexico.
Jan	Western Nuclear, Inc.	Shutdown Ruby Lake Mine, Grants, New Mexico.
Jan	Homestake Mining Co.	Mill restart after 3-month down period, Grants, New Mexico.
Jan	Rio Algom Corp.	Shutdown Mi Vida mine, La Sal, Utah.
Feb	Chevron Resources Co.	Announced plan to re-open Mt. Taylor mine for 12-month period of engineering and economic evaluation, Grants, New Mexico.
Feb	Cotter Corp.	Mill placed on stand-by, Cañon City, Colorado.
Feb	Western Nuclear, Inc.	Announced intent to sell all uranium properties.
Mar	UNC Resources Corp.	Announced intent to dispose of all uranium properties.
April	Homestake Mining Co.	Announced suspension of milling and cutback on all mine activity, Grants, New Mexico.
April	Anaconda Mining Co.	Announced plan to sell all uranium properties.
May	US Government	Legislation for a $1 billion fund to clean up active uranium tailings piles in US sent to Congress.
June	Texaco Minerals Co.	Decommissioning of Petrotomics mill underway, Shirley Basin, Wyoming.
June	Rocky Mt. Energy/ Mono Power, Inc.	Announced termination of joint venture agreement for all uranium projects, including the Bear Creek project, Powder River Basin, Wyoming, effective 7-1-85.
June	Amoco Minerals Co.	To transfer all mineral projects to Cyprus Minerals Corp., 7-1-85
June	Uranium Producers of America	Filed suit against DOE regarding uranium enrichment policies.
July	Anaconda Mining Co.	Announced intent to sell entire mining company.
Aug	State of Wyoming	Filed "friend of the court" brief before US District Court in support of UPA lawsuit regarding DOE's uranium enrichment policies.
Sep	Homestake Mining Co.	Closed mill and reduced mining to two crews and recovery from mine waters, Grants, New Mexico.
Sep	Energy Fuels Nuclear	Entered exploration joint venture with CEGB, Arizona Strip district.
Sep	State of New Mexico	State and DOE agreed on procedure for stabilizing the Phillips/UNC tailings; first such agreement ever for the industry.
Sep	US DOE	Declared US uranium industry to be nonviable.
Oct	Conoco, Inc.	Concluded ISL production and began full restoration, Trevino project, Hebbronville, Texas.
Oct	Cotter Corp.	Start-up of mill at Cañon City, Colorado.
Nov	Uranium Resources, Inc.	Resubmitted mining application to the Texas Water Commission for the Kingsville Dome project, near Kingsville, Texas.
Dec	Minatome Corp.	Entered exploration joint venture with Concord Oil Corp. on property in vicinity of Palangana Dome, Duval County, Texas.
Dec	Cotter Corp.	Closed mill after 3-month run, Cañon City, Colorado.
Dec	Quivira Mining Co.	Request made to Bureau of Land Management for stand-by status of Church Rock mines in final review. If granted, mines will be sealed and allowed to flood.

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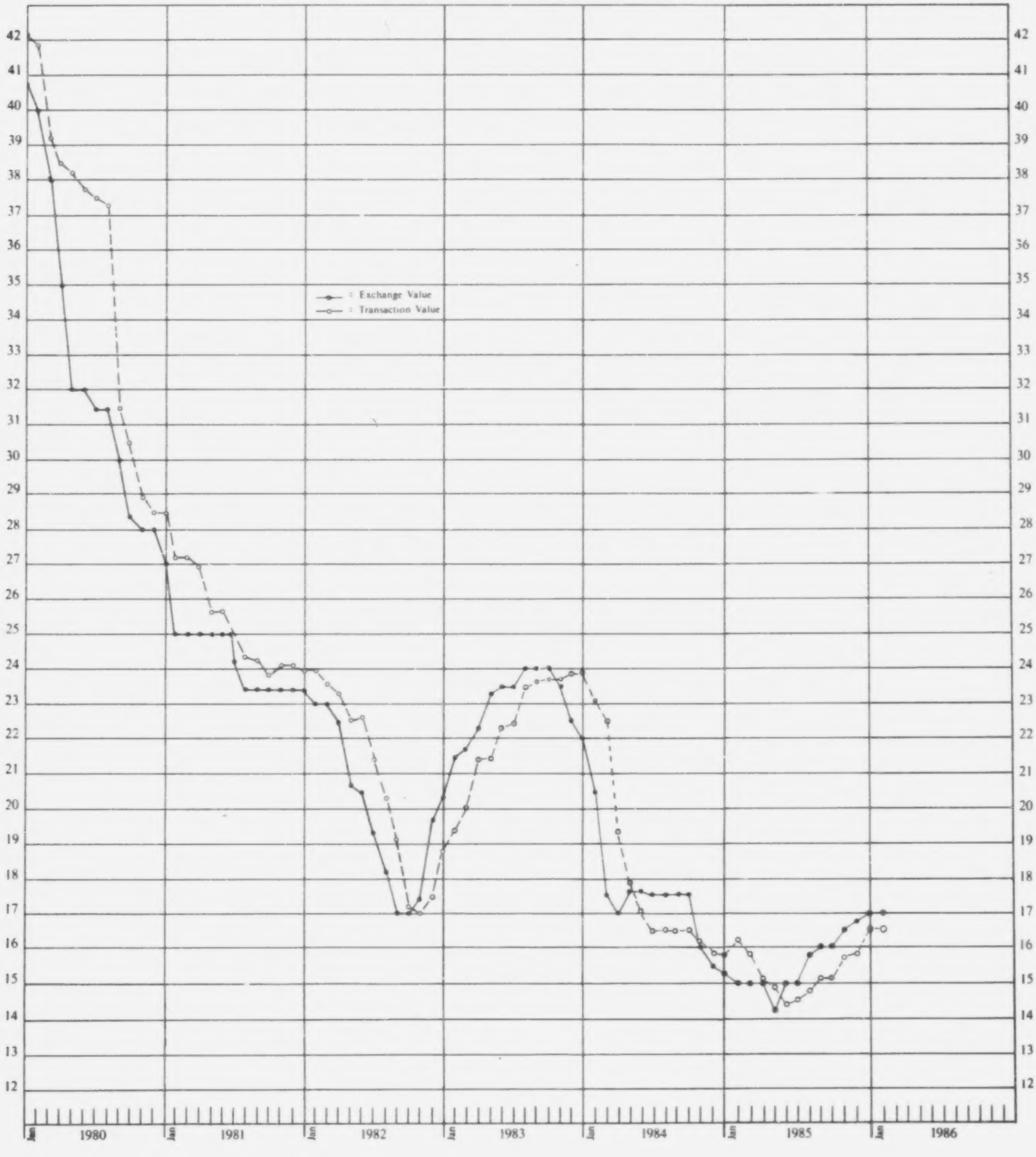
EXCHANGE AND TRANSACTION VALUES SINCE JANUARY 1980

Determined as of the last day of the month indicated



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HISTORICAL MARKET DATA

HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	32.50	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	**17.00**											

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	**16.55**											

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U in UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	**1.60**											

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AUSTRALIA

	Price Index of Materials Used in Manufacturing Industry—All Groups[1] (1969=100) (1976=100)	**Award Rates of Pay Indexes Australia—Adult Males In Mining Wage and Salary Earners, Weekly Rates[2]**
1975 Avg.	150.4	132.6
1976 Avg.	168.4	160.9
1977 Avg.	192.0	179.0
1978 Avg.[3 4]	198.5	190.0
1979 Avg.	248.8	127.9
1980 Avg.	321.8	140.8
1981 Avg.	355.3	154.1
1982 Avg.[5]	368.6	174.9
1983 Avg.	401.2	181.8
Jan 1984	399.2	188.7
Feb 1984	402.5	188.6
Mar 1984	403.9	188.4
Apr 1984	404.2	196.2
May 1984	403.8	197.0
Jun 1984	404.9	197.4
Jul 1984	408.3	197.4
Aug 1984	413.2	197.4
Sep 1984	411.9	197.4
Oct 1984	408.5	197.4
Nov 1984	407.1	197.4
Dec 1984	406.0	197.4
FY84 Avg.[6]	402.1	—
FY85 Avg.[6]	422.2	—
Jan 1985	409.3	197.4
Feb 1985	416.1	197.4
Mar 1985	430.9	197.4
Apr 1985	440.8	202.3
May 1985	454.4	202.3
Jun 1985	458.9	202.4
Jul 1985	459.0	202.3
Aug 1985	454.9	202.4
Sep 1985	447.7	202.4
Oct 1985	—	202.4

P = Preliminary R = Revised since last month

[1] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0).

[2] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

[3] Monthly data for 1970-78 appear on pages 4.7 and 4.8 of Report 138.

[4] Annual averages prior to 1979 reflect index base no longer in use.

[5] Monthly data for 1979-82 appear on page 35 of Report 184.

[6] Annual averages are for financial year ending June 30.

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GOVERNMENT STATISTICS

CANADA

	Industry Selling Price Index: Manufacturing[1] (1971 = 100)	Wage-earner Data: Average Hourly Earnings (C$)[2]					
		Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells[3] (SIC 051-099)	Primary Metal Industries Non-ferrous[4] (SIC 296)	Primary Metal Industries Non-ferrous[4] (SIC 298)	Chemicals and Chemical Products[5] (SIC 372-379)
1979 Avg.[6]	217.9	—	9.60	9.66	—	—	7.67
1980 Avg.	247.2	—	10.58	10.80	—	—	8.50
1981 Avg.	288.7	—	12.02	12.23	—	—	9.53
1982 Avg.[7]	288.8	—	13.74	13.92	—	—	10.63
1983 Avg.	298.8	—	—	14.30	—	—	11.17
Jan 1984	305.4	17.74	15.27	14.74	11.91	10.84	11.69
Feb 1984	306.6	17.90	15.59	14.90	12.04	10.82	11.51
Mar 1984	308.7	18.05	15.52	14.82	12.14	10.84	11.58
Apr 1984	310.5	18.06	15.83	15.10	11.96	10.34	11.63
May 1984	310.6	18.48	15.64	15.06	12.11	10.16	11.65
Jun 1984	311.0	18.08	15.48	14.80	12.38	10.40	11.66
Jul 1984	312.9	17.81	15.72	14.92	12.53	10.18	11.82
Aug 1984	312.7	17.24	15.36	14.92	12.44	10.34	11.78
Sep 1984	312.3	17.68	15.96	15.34	12.51	10.52	11.90
Oct 1984	312.3	17.64	16.15	15.26	12.69	10.56	11.96
Nov 1984	313.6	18.04	16.13	15.43	12.47	10.51	11.96
Dec 1984	314.2	17.95	16.39	15.60	12.16	10.40	11.99
1984 Avg.	310.9	17.88	—	15.07	12.28	10.49	11.76
Jan 1985	315.9	18.05	16.13	15.60	12.32	10.80	12.04
Feb 1985	316.5	18.78	16.41	15.68	12.52	11.05	12.06
Mar 1985	318.0	18.24	16.21	15.57	12.44	10.97	12.02
Apr 1985	318.3	18.63	16.44	15.80	12.81	11.23	12.04
May 1985	318.8	19.41	16.51	15.63	12.76	11.25	12.15
Jun 1985	319.1	18.49	16.20	15.49	12.89	11.14	12.14
Jul 1985	319.4	18.14	16.19	15.41	12.96	11.17	12.13
Aug 1985	319.2	17.07	15.76	15.30	12.97	11.31	12.19
Sep 1985	319.4	18.53R	16.55R	15.72R	12.95R	11.39R	12.26R
Oct 1985	320.2	18.74	16.51	15.70	13.14	11.53	12.33
Nov 1985	—	19.09P	16.73P	15.89P	13.00P	11.30P	12.66P

P = Preliminary R = Revised since last month

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[1] Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision.

[2] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours" (Catalogue 72-002).

[3] Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

[4] Beginning with the April 1983 figure, Primary Metal Industries, non-ferrous is split into SIC 296 and SIC 298.

[5] Chemical and Chemical Products prior to April 1983 was SIC 370-379. The new series is from a new survey which includes all companies and is based on a 1970 classification. The old survey only included companies of 20 employees or more.

[6] Monthly ISPI for 1977 and 1978 appear on page 4.10 of Report 138, and monthly wage-earner data for 1973-78 appear on page 4.11 of Report 138.

[7] Monthly data for 1979-1982 appear on page 37 of Report 184. On that page, the wage earner index entitled "Metal Mining, Including Milling (SIC 050-099)" should read "Total Mining (SIC 051-099)."

[8] Beginning with the April 1983 figure, Wage Earner Data are based on a census of all companies employing 200 or more wage earners, *plus* a random survey of companies employing fewer than 200 wage earners. Prior to April 1983 only companies employing 200 or more wage earners are included in the Wage Earner Data.

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REPUBLIC OF SOUTH AFRICA

		Average Declared Working Costs per per Metric Ton of Gold Ore Milled (Rand)[1]	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100)[2]	Consumer Price Index[3] (1980 = 100)[4]	Producer Price Index All Groups[5] (1980 = 100)	Total Employment in Mining and Quarrying (Code 35)[6]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[6]
1975	Avg.	16.71	—	157.2	100.0	639,473	1,003,617
1976	Avg.	19.30	—	174.7	115.1	671,240	1,212,983
1977	Avg.	23.87	—	194.4	130.0	712,006	1,420,670
1978	Avg.	27.14	—	137.2	142.7	664,571	1,537,169
1979	Avg.[7]	30.18	—	155.3	164.5	692,209	1,830,632
1980	Avg.[8]	35.53	—	176.7	192.1	714,379	2,279,615
1981	Avg.	41.89	—	206.5	218.3	728,506	2,820,505
1982	Avg.[9]	47.25	104.2	233.5	248.7	707,552	3,246,071
1983	Avg.	51.87	115.0	262.2	274.8	696,579	3,644,772
Jan	1984	—	—	274.7	283.3	689,807	326,619
Feb	1984	—	—	278.4	286.5	702,553	335,906
Mar	1984	55.30	123.1	281.9	288.0	715,628	342,332
Apr	1984	—	—	286.1	290.2	712,963	327,550
May	1984	—	—	288.3	292.6	710,040	327,937
Jun	1984	56.95	126.2	291.2	295.3	717,009	347,121
Jul	1984	—	—	295.1	296.0	717,121	369,964
Aug	1984	—	—	297.0	300.8	721,905	361,357
Sep	1984	60.64	133.2	299.9	304.1	721,470	359,218
Oct	1984	—	—	303.7	308.7	717,865	363,755
Nov	1984	—	—	307.4	312.8	717,396	369,771
Dec	1984	62.92	138.6	309.4	315.9	701,198	365,234
Jan	1985	—	—	177.1	166.6	711,366	376,777
Feb	1985	—	—	182.8	171.3	727,932	361,823
Mar	1985	64.48	142.4	183.6	173.0	708,809	371,380
Apr	1985	—	—	187.4	174.0	724,187	369,005
May	1985	—	—	189.5	177.7	708,085	373,478
Jun	1985	67.42	148.9	191.9	179.2	724,587	395,543
Jul	1985	—	—	193.6	180.7	738,228	419,106
Aug	1985	—	—	195.6	183.2	734,121	416,777
Sep	1985	70.47	155.3	197.8	184.8	732,836	419,883
Oct	1985	—	—	200.8	188.1	—	—
Nov	1985	—	—	203.4	196.0	—	—
Dec	1985	—	—	207.4	—	—	—

---

[1] Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly.

[2] Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

[3] Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."

[4] The basis for calculation prior to January 1985, 1975 = 100. For annual averages prior to 1978, April 1970 = 100.

[5] Previously known as the Wholesale Price Index, now the Producer Price Index. The computation remains the same. The basis for calculation prior to January 1985, 1975 = 100.

[6] Bulletin of Statistics, Department of Statistics, Pretoria.

[7] Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 4.9 of Report 140.

[8] Monthly data for Codes 35 and 40, 1977-1980, appear on page 28 of Report 157.

[9] Monthly data for 1979-82 appear on page 39 of Report 184.

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GOVERNMENT STATISTICS

UNITED STATES

	Producer Price Index[1]		Consumer Price Index[2]	GNP Implicit Price Deflator[3,4]	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[5]			
	Industrial Commodities (1967 = 100)	All Commodities (1967 = 100)	(1967 = 100)	(1982 = 100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980 Avg.[6]	274.8	268.8	246.8	178.64	10.26	10.63	8.30	6.94
1981 Avg.	304.1	293.4	272.4	195.51	11.55	11.98	9.12	7.62
1982 Avg.[7]	312.3	299.3	289.1	207.15	12.33	12.94	9.96	8.21
1983 Avg.	315.8	303.1	298.4	215.63	12.57	13.43	10.59	8.65
Jan 1984	319.1	308.0	305.2	—	12.68	13.37	10.88	8.91
Feb 1984	320.6	308.9	306.6	—	12.83	13.33	10.87	8.91
Mar 1984	321.9	311.0	307.3	106.6R	12.89	13.32	10.96	8.94
Apr 1984	322.5	311.4	308.8	—	12.94	13.29	10.94	8.94
May 1984	323.3	311.7	309.7	—	13.02	13.36	11.99	8.94
Jun 1984	323.9	311.4	310.7	107.6R	12.99	13.39	11.00	8.97
Jul 1984	324.0	312.0	311.7	—	13.06	13.34	11.09	9.00
Aug 1984	323.5	310.9	313.0	—	13.15	13.50	11.09	9.05
Sep 1984	322.3	309.5	314.5	108.6R	13.23	13.38	11.20	9.13
Oct 1984	323.2	309.4	315.3	—	13.26	13.53	11.29	9.15
Nov 1984	323.8	310.4	315.3	—	13.27	13.74	11.31	9.20
Dec 1984	323.0	309.9	315.5	109.6R	13.32	13.64	11.34	9.32
1984 Avg.	322.6	310.3	311.1	108.1R	13.05	13.43	11.08	9.04
Jan 1985	322.9	309.5	316.1	—	13.29	13.70	11.39	9.33
Feb 1985	322.5	309.2	317.4	—	13.30	13.73	11.39	9.33
Mar 1985	322.6	308.7	318.8	110.4R	13.29	13.95	11.37	9.39
Apr 1985	323.8	309.3	320.1	—	13.43	13.62	11.48	9.40
May 1985	325.3	309.8	321.3	—	13.24	13.59	11.46	9.39
Jun 1985	324.8	309.2	322.3	111.3R	13.23	13.66	11.52	9.46
Jul 1985	324.4	309.0	322.8	—	13.45	13.82	11.60	9.47
Aug 1985	323.7R	307.3R	323.5	—	13.55	13.69	11.62	9.50
Sep 1985	322.5	305.8	324.5	112.1R	13.44	13.66	11.67	9.55
Oct 1985	324.4	308.0	325.5	—	13.49R	13.64R	11.72R	9.56
Nov 1985	325.0	309.7	326.6	—	13.49P	13.95P	11.82R	9.61R
Dec 1985	325.2	310.2	327.4	113.0	—	—	11.94P	9.67P

P = Preliminary R = Revised since last month

[1] US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

[2] US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items.

[3] US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

[4] The basis for calculation of this index was revised to 1982 = 100. 1984 and 1985 figures have been adjusted to that basis. The basis for calculation prior to 1984, 1972 = 100.

[5] US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for 1977-1978 are adjusted to the March 1979 benchmark. Data for January 1979 and beyond are adjusted to the March 1980 benchmark.

[6] Monthly data 1970-1978 for Producer Price Index-Industrial Commodities, Consumer Price Index, and Employment and Earnings SIC codes 10, 333, and 28, and quarterly data for GNP Implicit Price Deflator appear on pages 4.6-4.8 of Report 139.
Monthly data 1977-1978 for Employment and Earnings SIC Codes 10, 333, and 28 appear on page 33 of Report 147.
Monthly data 1970-1978 for Employment and Earnings SIC Code 36 appear on page 23 of Report 154.
Monthly data 1977-1980 for Producer Price Index-All Commodities, appear on page 21 of Nuexco Report 158.

[7] Monthly data 1979-1982 for all listed indices appear on page 41 of Report 184.

NUEXCO

REPRESENTATIVES AND CONSULTANTS

AUSTRALIA

Peter Stork
Oratom Consulting
5 Gould Ave.
St. Ives
NSW 2075, Australia
Telephone: (61-2) 449-6783
Telex: 23976 (COMTLX)

JAPAN

Kazy Yokota
Japan Tech Services
Ohkura Building (3F)
1-4-10 Shiba Daimon
Minato-ku, Tokyo, Japan
Telephone: (81-3) 431-6031, 6025
Telecopy: (81-3) 434-6674
Telex: 242-5060 (JATECH J)

SOUTH AFRICA

Chris I. Von Christierson
Southern Prospecting (Pty) Limited
P.O. Box 61409
Marshalltown 2107
Republic of South Africa
Street Address:
10th Floor
Eagle Star House
70 Fox Street
Johannesburg 2001
Telephone: (27-11) 838-1868
(27-11) 834-4211
Telex: 4-89878 SA

TAIWAN

Edward Bee
Bee & Liang Company, Ltd.
14 FL Universal Business Center
NO. 663, Tun Hwa South Road
P.O. Box 1396
Taipei, Taiwan R.O.C.
Telephone: (886-2) 704-9630
TWX: 785-11570 (BEELIANG)

UNITED STATES

Harold C. Lindberg
83-A Hardee Lane
Whispering Pines, N.C. 28327
Telephone: (919) 949-3622

M. Jerry Reaves
Suite 905
Ten Piedmont Center
Atlanta, Georgia 30305
Telephone: (404) 262-7375

Ralph O. Smith
141 Braemar Drive
Cheshire, Connecticut 06410
Telephone: (203) 272-6246

SPECIAL CONSULTANTS

George J. Stathakis
International Investment Banking

James C. C. Stewart
U.K. Nuclear Industry

Claus C. Thiesen
Japan Nuclear Industry

W. Bryan Webster
International Business Development

J. Robert Wolcott
International Business Development

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EXECUTIVE SUMMARY
REPORT 210
(All data as of January 31, 1986)

Exchange Value
\$17.00, unchanged

The **Exchange Value** is **\$17.00** per pound U_3O_8, unchanged since last month.

UF_6 Value
\$47.00, unchanged

The **UF_6 Value** is **\$47.00** per kilogram U as UF_6, unchanged since last month.

Transactions

Five recent natural uranium sales and one of low-enriched uranium are reported, involving approximately 900 thousand pounds equivalent U_3O_8 in the near term and another 8 million pounds equivalent U_3O_8 in the longer term. Four of the sales involved spot or near-term delivery and two met the conditions for inclusion in the Transaction Value. One transaction involved natural UF_6.

Supply-Demand Ratio
declined to 1.4:1

Active spot and near-term **uranium supply** amounts to **3.9 million** pounds U_3O_8 equivalent, up 345 thousand pounds since last month. Active spot and near-term **uranium demand** totals **2.8 million** pounds, up 485 thousand pounds. The spot and near-term **supply-demand ratio** declined to **1.4:1.**

Transaction Value
\$16.55, unchanged

The **Transaction Value** is **\$16.55** per pound U_3O_8, unchanged since last month. The calculation includes 13 transactions involving a total of 2.2 million pounds U_3O_8 and equivalent UF_6, and covers a period of 4 months.

Loan Rate
unchanged at 5%

The **Loan Rate** is **5 percent** per annum, unchanged.

Conversion Value
unchanged at \$1.60

The **Conversion Value** is **\$1.60** per pound U as UF_6, unchanged since last month. Active secondary market supply for conversion services for delivery within three years totals 575 thousand pounds U as UF_6. No active demand is reported. Two secondary market conversion transactions are reported, involving approximately 750 thousand pounds U as UF_6.

SWU Value for
delivery within
one year: \$80

The **SWU Value** at .3 tails and for delivery within one year is **\$80** per SWU, unchanged since last month. Two secondary market SWU transactions are reported, involving 200 thousand SWUs of Eurodif and DOE origin.

* * *

Analysis and
Commentary

The recent construction progress made on nuclear power units outside of the USA indicates that non-US nuclear generating capacity is likely to grow steadily in the next several years, continuing a trend that has existed over the past three years.

Europe

Superphénix, the 1,200-MWe liquid-sodium Fast Breeder Reactor (FBR) owned by a European consortium, was recently connected to the French electricity grid, marking a milestone in European nuclear development. In general, however, the cost of the FBR will prevent most nations from undertaking such a project at least until electricity demand and fuel prices are considerably higher than today.

France

Some of the uranium holdings of the large energy and mining group Total have been reorganized. Total has interests in France, Australia, the USA, and in Namibia's Rossing mine.

Japan

The Japanese utilities recently announced 1985 operating performance results for their 32 commercial nuclear units, which generated 24 percent of the nation's electricity in 1985.

South Africa

Fourth-quarter uranium production from Chamber of Mines producers amounted to 3.1 million pounds U_3O_8. Total 1985 figures indicate a 15-percent decline in production compared to 1984.

Raw Materials

1985 US uranium production fell almost 30 percent from the 1984 total, as the decline in activity in all phases of the uranium industry continued through its fifth consecutive year.

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NUEXCO REPORT 210 FIGURES OF THE MONTH (January 31, 1986)	This Month (Report 210)	Last Month (Report 209)	12 Months Ago (Report 198)
Exchange Value[1]	17.00	17.00	15.00
Transaction Value[1]	16.55	16.55	16.20
UF_6 Value[2]	47.00	47.00	—
Loan Rate[3]	5%	5%	6%
Conversion Value[4]	1.60	1.60	1.00
Near-Term Uranium Supply[5]	3.9	3.6	4.2
Near-Term Uranium Demand[6]	2.8	2.3	1.3
Near-Term Supply-Demand Ratio	1.4	1.5	3.3
Recent Uranium Sales:			
Number of Transactions[7]	6	7	1
Quantity of Material[8]	8.7	0.9	0.2
Nuexco SWU Value:[9]			
at 0.3 tails assay and delivery within one year	80	—	—
USDOE SWU Prices:			
USEC	125.00[10]	125.00[10]	135.00
AFC	153.00[11]	153.00[11]	153.00[11]
Requirements	157.00[11]	157.00[11]	157.00[11]
Market Value of Enriched UF_6[12,13]:			
2.5 w/o U_{235}	460	460	506
3.0 w/o U_{235}	589	589	656
3.5 w/o U_{235}	720	720	808
4.0 w/o U_{235}	854	854	964

---

[1] US $ per pound U_3O_8 equivalent.

[2] US $ per kilogram U as UF_6.

[3] Per annum.

[4] US $ per pound U as UF_6.

[5] Active inquiries to sell, for delivery within 12 months after contract signing (millions of pounds U_3O_8).

[6] Active inquiries to purchase, for delivery within 12 months after contract signing (millions of pounds U_3O_8).

[7] Uranium sales only; does not include loans, conversion, or SWU transactions.

[8] Millions of pounds U_3O_8, equivalent.

[9] US $ per SWU.

[10] Effective 10/1/85.

[11] Effective 10/1/84.

[12] Calculated using the Nuexco Exchange Value, Conversion Value, and 0.30 percent tails assay. From 4/30/85 to 11/30/85, calculations used in the Nuexco SWU Value for DOE origin and delivery by the end of FY86. As of 12/31/85, calculations use the SWU Value for delivery within one year.

[13] US $ per KgU as UF_6, rounded to the nearest $.

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MARCH 1986 NUMBER 211

MONTHLY REPORT

ON THE NUCLEAR FUEL MARKET

NUEXCO

HEADQUARTERS

Three Park Central
1515 Arapahoe Street
Suite 1045
Denver, Colorado 80202
Telephone: (303) 893-4015
Telecopy: (303) 825-4821
Telex: 450202 (NUEXCO DVR)

Chairman of the Board of Partners
Oren L. Benton

Vice Chairman of the Board of Partners
Samuel R. Freeman

EASTERN UNITED STATES

100 Prospect Street
Century Plaza South
Stamford, Connecticut 06901
Telephone: (203) 323-1999
Telecopy: (203) 325-1483
Telex: 4750124 (NUEXCO C)

Managing Broker
Earl E. Hoellen, Jr.

WESTERN UNITED STATES

Building 3, Suite 290
3000 Sand Hill Road
Menlo Park, California 94025
Telephone: (415) 854-1510
Telecopy: (415) 854-2115
Telex: 470674 (NUEXCO UI)

Managing Broker
George White, Jr.

EUROPE

13 chemin du Levant
01210 Ferney-Voltaire
France
Telephone: (33-50) 428035
Telecopy: (33-50) 428526
Telex: 385288 (NUEXCO F)

Managing Broker
James E. Vaughan

REGIONAL MANAGING BROKERS

AFRICA
James E. Vaughan

AUSTRALIA
George White, Jr.

CANADA
Wayne D. Fowler
(303) 893-4015

FAR EAST
Christian C. Guitton
(415) 854-1510

MEXICO AND SOUTH AMERICA
Earl E. Hoellen, Jr.

(See inside back cover for list of Representatives and Consultants)

NUEXCO

MONTHLY REPORT ON THE NUCLEAR FUEL MARKET
March 1986 No. 211

GEORGE WHITE, JR., *EDITOR* CLARK M. BEYER, *ASSOCIATE EDITOR*

PRICING

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To Our Readers

Nuexco will host a hospitality suite during the Atomic Industrial Forum's Fuel Cycle Conference in Phoenix, Arizona, April 1-4, at the Sheraton Scottsdale Resort. We look forward to seeing you there.

* * *

Nuexco soon will mail the 1985 Annual Review to our full-service subscribers. This Special Report covers major nuclear fuel market developments throughout the world in 1985 and early 1986. In particular, it analyzes the condition and pricing trends of the spot/near-term markets for uranium and secondary market enrichment services. Nuexco market values for 1985 have been brought together in a series of tables for reference.

If you would like to purchase copies of the 1985 Annual Review, they are available for $100 each. Please contact Clark Beyer at our Headquarters:

Nuexco
Three Park Central
1515 Arapahoe Street
Suite 1045
Denver, Colorado 80202
Telephone: (303) 893-4015
Telecopy: (303) 825-4821
Telex: 450202 (NUEXCO DVR)

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NATURAL URANIUM AND SECONDARY MARKET CONVERSION

(All data as of February 28, 1986)

The **Exchange Value** is **$17.00** per pound U_3O_8, unchanged since last month. **Active supply** of natural uranium (concentrates and UF_6) for spot or near-term delivery totals **2,405,000** pounds U_3O_8 equivalent, down 1.5 million pounds since last month. The corresponding figure for **active demand** is **975,000** pounds, down 1.8 million pounds. The spot and near-term **supply-demand ratio** declined to **2.5:1.**

The *Current Market Data* section of this Report lists four natural uranium sales and one of low-enriched uranium, involving approximately 1,000,000 pounds equivalent U_3O_8. All of the transactions involved near-term delivery and three met the criteria for inclusion in the current Transaction Value calculation. One transaction involved natural UF_6.

The **Transaction Value** is **$16.70** per pound U_3O_8, up $0.15 since last month. The calculation extends over a 5-month period and includes 16 transactions involving 2.6 million pounds equivalent U_3O_8.

The **UF_6 Value** is **$48.00** per kilogram U in UF_6, up $1.00 since last month.

The **Conversion Value** is **$1.80** per pound U in UF_6, up $0.20 since last month. Active supply of secondary market conversion services for delivery within three years totals 865 thousand pounds U as UF_6. Active demand totals 950 thousand pounds U as UF_6. No secondary market conversion transactions are reported.

The **Loan Rate** is unchanged at **5 percent** per annum.

* * *

The Exchange Value remained at $17.00 as significant quantities of uranium near that price level were still available as of the end of the month. There was some market activity, on the order of one million pounds, but the market-clearing purchasing that occurred at the time of the last price rise did not occur in February. This month, one transaction involving a smaller quantity for near-term delivery took place slightly above the current Exchange Value, but some larger quantities for later delivery command effective prices nearer to the Exchange Value. Without large blocks of hard demand as of the end of the month, there are no strong forces acting to drive up prices, and buyers generally are reluctant to pay significantly more than $17.00 for immediate to near-term delivery. This situation will continue until the remaining material priced at $17.00 is cleared from the market. Currently, there is insufficient near-term demand to sustain the gradual upward price movement that began in mid-1985. Throughout the next six months, however, some of the longer-term requirements of many utilities are likely to move into the near-term market.

Despite the lack of movement in the Exchange Value, the UF_6 Value rose slightly to $48.00 this month. Generally, the UF_6 market is thinner than that of concentrates, i.e. the supply and demand of U_3O_8 usually exceeds that of UF_6, and utilities' primary conversion commitments often lessen their desire to obtain uranium in the form of UF_6. Thus, the market for UF_6 is inherently more sensitive to small changes in supply-demand relationships, changes in the conversion market, and other external events than is the market for concentrates. This market sensitivity was demonstrated this month in particular, as two circumstances accounted for the rise in the UF_6 Value:

1. Although active near-term demand for uranium in any form is small, much of the current demand is for UF_6.

2. The firming of the secondary market for conversion services, probably due in part to uncertainties of supply from Sequoyah Fuels' conversion facility, has created slightly more interest in UF_6. Thus, because it does not need to be converted, UF_6 is more fungible than U_3O_8. Nuexco expects to see a significantly greater interest in UF_6 emerge if operations at the Sequoyah Fuels plant do not resume in the next several weeks.

* * *

The Conversion Value rose to $1.80 this month, the first change in that value since June 1985, as a significant quantity of demand entered what had been a rather dormant market. Over the past six months, buyers required prices around the $1.60 level to become sufficiently motivated to take secondary market conversion services. Some discretionary sellers moved in and out of the market, usually unwilling to accept that price. Because of the temporary halting of operations at one of the five free world conversion facilities, however, several large blocks of demand appeared. Some utilities will likely begin redistributing excess conversion, either through secondary market sales or even UF_6 loans, if Sequoyah Fuels is not allowed to resume operations within the next several weeks.

* * *

ENRICHED URANIUM AND SWUS

The **SWU Value** as of February 28, 1986, is $80 per SWU. This refers to SWU at a tails assay of 0.30 weight-percent U_{235} and for delivery within one year. Four secondary market SWU transactions are reported this month, involving approximately 200 thousand SWUs.

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PRICING

In the wake of four transactions, the secondary market for SWU is extremely thin, and quantities as low as ten thousand SWU can have a significant effect on the market. Depending upon the individual needs of the buyer and seller, large premiums or discounts can be required in order to conclude transactions. One utility with a large block of SWU was apparently poised to enter the market near the end of February, but the SWU did not appear for sale as of the last day of the month. If the seller enters the market, however, its presence could have a considerable effect on prices, provided buyers emerge.

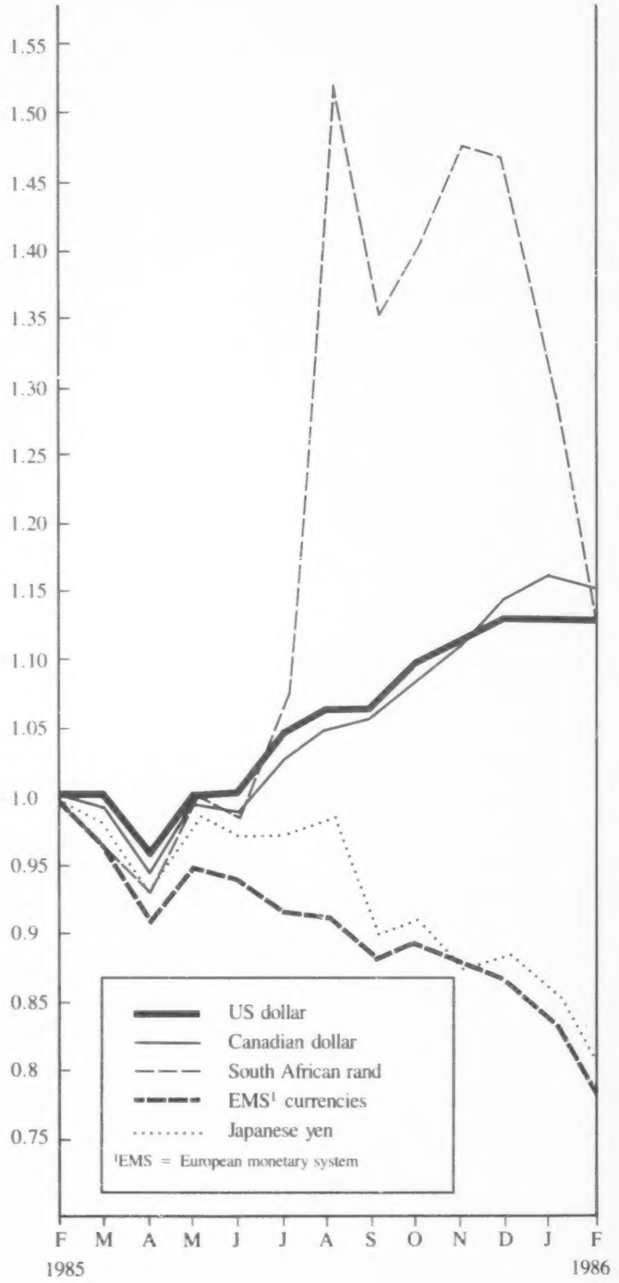
* * *

RECENT EFFECT OF US DOLLAR EXCHANGE RATES ON URANIUM PRICES

Changes in the value of the US dollar relative to other currencies have had an important effect on the uranium market in recent months. One year ago, the US dollar reached a record high against many non-US currencies at the same time that uranium prices expressed in US dollars reached their lowest level in ten years. Since February 1985, the US dollar has declined steadily against the Japanese yen and European currencies. (European currencies are linked by the European Monetary System (EMS[1]), so changes in the dollar value of the French franc and the West German mark, for example, have been virtually identical.) The result, illustrated in the following table and figure, is that uranium prices in many consumer countries have declined sharply in recent months even though prices expressed in US dollars have risen. This trend has improved the market for many non-US uranium buyers, but has worsened the condition for European sellers.

The situation has been different in recent months for the two largest uranium-producing countries, Canada and South Africa. The Canadian dollar is more closely linked to the US dollar than to European currencies, and has maintained its position relative to the US dollar until the past three months, when the US dollar has in fact gained against the Canadian dollar to the benefit of Canadian sellers. The value of the South African rand has fluctuated dramatically over the past year. Although it followed the develoment of other non-US currencies in the first half of 1985, the economic and political crisis in the second half of the year caused prices in rands to rise to unprecedented levels, making 1985 a record year for South African producers, which price most of their contracts in US dollars. Over the past month, the value of the rand has strengthened with the recovery of the South African financial system.

RATIO OF RECENT EXCHANGE VALUES TO EXCHANGE VALUE OF FEBRUARY 28, 1985 MEASURED IN SELECTED CURRENCIES



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[1] The EMS is an agreement among several European countries, including Belgium, the Federal Republic of Germany, France, Italy, and the Netherlands, that keeps the exchange rates among the various participating currencies within a narrow trading range, except in cases of official devaluations. For example, Italy devalued the lira in the fall of 1985.

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EXCHANGE VALUE IN SIX SELECTED CURRENCIES FROM FEBRUARY 1985 TO FEBRUARY 1986[1]

Month/Year	USA (dollar)	Canada (dollar)	Fed. Rep. Germany (mark)	France (franc)	South Africa (rand)	Japan (yen)
Exchange Values						
Feb 85	15.00	20.73	49.85	152.39	30.00	3881
Mar 85	15.00	20.53	46.90	143.13	28.71	3793
Apr 85	14.25	19.49	44.36	135.46	27.75	3598
May 85	15.00	20.64	46.30	140.98	29.97	3773
Jun 85	15.00	20.45	45.76	139.41	29.50	3732
Jul 85	15.75	21.29	44.50	135.43	32.21	3739
Aug 85	16.00	21.78	44.46	135.82	45.71	3793
Sep 85	16.00	21.98	42.94	130.61	40.30	3458
Oct 85	16.50	22.55	43.43	132.32	42.04	3507
Nov 85	16.75	23.08	42.62	129.85	44.14	3368
Dec 85	17.00	23.78	41.87	128.40	43.87	3413
Jan 86	17.00	24.14	40.38	123.82	38.72	3275
Feb 86	17.00	23.97	37.91	116.28	33.66	3077
Currency Exchange Rates (per US dollar)[1]						
Feb 85	1.00	1.38	3.32	10.16	2.00	259
Feb 86	1.00	1.41	2.23	6.84	1.98	181
Net percent change against US dollar between February 28, 1985 and February 28, 1986						
	—	− 2	+ 33	+ 33	+ 1	+ 30
Net percent change of Exchange Value in given currency between February 1985 and February 1986						
	+ 13	+ 16	− 24	− 24	+ 12	− 21

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[1] Exchange Values are as of the last day of the month indicated. Currencies calculated using currency exchange rates published in the *Wall Street Journal* as of the last day of the month indicated.

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RECENT DOE ENRICHMENT DEVELOPMENTS

In late January 1986, the US Department of Energy (DOE) implemented aggressive moves to reinforce its position against both the legal challenge to its US Enrichment Contract (USEC) and the competitive challenge offered by other enrichment suppliers. The following analysis focuses on the two issues, their relationship and the possible consequences for DOE and its enrichment customers.

Customer Response to the Incentive Pricing Campaign

In late 1985, DOE announced an incentive pricing offer for FY91-95 enrichment services (Report 209), part of a series of moves designed to enhance its competitive position. The campaign was aimed at those utilities that had signed the USEC and had any unfilled requirements in that time period. The offer stipulates a base price of $85 per SWU for all uncommitted requirements. The base price is escalated according to changes in the US Gross National Product Implicit Price Deflator (GNPIPD) from the second quarter of 1985 until the second quarter of the calendar year preceding the fiscal year of delivery. (The GNPIPD is an indicator of inflation compiled by the US Department of Commerce, and is currently rising at a rate of approximately three percent per year.)

DOE established February 21, 1986 as the final date to accept the incentive price package. DOE probably hoped to force rapid decisions on its customers, as the deadline allowed little time for utilities to analyze alternate courses of action and for DOE's competitors to respond. DOE may have reasoned that its customers, lacking the time and information to consider all the financial, competitive, and flexibility implications of the offer (and of the proposed revision of the enrichment criteria), would choose the path of least resistance by accepting the new incentive package.

It is difficult to measure accurately the success of DOE's strategy. While February 21 was supposed to be the final date for accepting the new package, in fact the offer was still open as of the close of business on February 28. DOE refused to comment on which and how many customers had accepted. Nuexco's information indicates that in Europe all but one utility refused the offer. An informal telephone survey of US utilities revealed that some had accepted outright, at least ten had declined, and some had asked for extensions to study the matter further. In addition, some utilities accepted but attached conditions such that the "acceptances" might more properly be described as counterproposals. For instance, one utility conditioned its acceptance on the absence of any uranium import embargo, while another acceptance was conditioned on basis that the required payback to the US Treasury not exceed a specified amount. It seems likely that DOE's new business-oriented approach was a factor in the conditioned acceptances. Because DOE had indicated that it would negotiate, its customers apparently are doing precisely that. Ultimately, the positive response to the FY91-95 incentive price offer will probably fall far short of the response to the FY87-90 offer.

The lack of enthusiasm for the FY91-95 proposal is not surprising considering the following circumstances:

1. The uncertainty surrounding the USEC may have discouraged some utilities from placing even greater reliance on a supplier that may not be able to deliver services under an invalidated contract.

2. Similarly, some utilities may have determined that committing 100 percent of requirements to DOE as much as ten years in the future may leave them vulnerable to DOE's mandates for cost recovery and investment payback, which might take the form of uncompetitive pricing terms, delivery schedules, and termination charges.

3. The economic gains contained in the offer may have appeared too inconclusive and undemonstrable for some customers. The low price probably will not be *exceptional* in the enrichment market in the coming years, assuming current trends continue.

SWU prices are likely to decline still further over the next 10-20 years, as enrichment plant loads increase and lower-cost technologies are developed and implemented. DOE in particular has lowered its SWU price from $150 in FY84 to $135 in FY85, to $125 in FY86, and to $119 in FY87. While it is not certain that DOE will continue to lower the USEC base price, it is conceivable that the incentive price may closely approach the primary price in the 1990s.

Proposed New Criteria Governing Enrichment

On January 29, 1986, DOE formally proposed new criteria to govern its uranium enrichment contracts. The new criteria, submitted in a proposed amendment to the US Code of Federal Regulations, constituted the first substantial response to the ruling by a US District Court in September 1985 that the USEC does not conform to the existing criteria governing DOE contracts and therefore is "null and void." (Report 206 [October 1985] describes the Court ruling and the lawsuit against DOE.) Except for an appeal of the ruling, and various public assurances that the issue would be resolved in its favor, DOE took no concrete action immediately following the ruling. Apparently concluding that the most favorable resolution consisted of changing the federal regulations governing enrichment, DOE drafted extensive revisions to the existing criteria, and will submit the proposed criteria for a 45-day Congressional review once the final wording is established. The proposed criteria will become effective if during that time Congress does not object. If the

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changes are accepted, they will be applied retroactively to the USEC, at which point a number of legal complications are certain to arise, including renewed litigation from the US producer group.

Among the proposed changes in the criteria are the following significant points.

1. *Enrichment of Foreign-Origin Uranium*. (§762.3) "Domestic customers must certify the country of origin of feed material delivered to DOE." No restrictions are specified against any particular origin, and non-US customers are not required to certify feed origin, but this requirement will facilitate the monitoring of non-US uranium use.

2. *Prices*. (§762.4) "DOE shall negotiate prices in individual enrichment contracts in accordance with an overall approach intended to maintain the long-term competitive position of DOE while obtaining the recovery of the government's costs over a reasonable period of time." Because neither the phrase "long-term competitive position" nor "a reasonable period of time" is defined, this section could be used by DOE to justify a wide-ranging, subjective price structure which varies from one customer to another and *is not subject to Congressional review*. There is no reference to floor or ceiling prices.

3. *Costs*. (§762.5) "DOE will establish charges for enrichment services on a basis that recovers appropriate government costs over a reasonable period of time. Such costs will be determined on a basis that includes the costs incurred in providing enrichment services to civilian customers ..." DOE apparently seeks to assure its customers that it will not spend more than it earns. Nevertheless, the unspecified time constraint and the term "*appropriate* government costs" allow DOE ample flexibility to act in an unaccountable manner in any particular fiscal year.

4. *Nondiscrimination*. (§762.7) "The same prices, as well as other terms and conditions, shall be available to all similarly situated customers on a nondiscriminatory basis, reflecting the cost of the enrichment services supplied to those customers." The nondiscriminatory claim is effectively nullified by the ambiguity of the phrase "similarly situated," and probably will cause problems for utilities that want to be assured of getting the best possible contract terms. As individual customers claim uniqueness that warrants lower prices and more favorable terms and conditions, this clause will undoubtedly foster controversy over the unequal treatment of different utilities, effectively *inviting* charges of discrimination.

It is not at all certain that the new criteria proposed by DOE will survive the 45-day Congressional review. Various political interest groups could use the opportunity to pressure DOE into certain concessions. One source of opposition probably will be Senator Pete Dominici (R, New Mexico), whose vocal support of the US uranium production industry led him to advocate legislation designed to limit non-US uranium imports. Opposition by the General Accounting Office (GAO) to DOE's accounting practices and the $3.5 billion valuation of the current enrichment facilities could endanger DOE's entire pricing approach. If the facilities were valued higher, repayments to the Treasury would have to be increased or accelerated. Representatives concerned with the fiscal implications of the Gramm-Rudman-Hollings Act, the federal deficit reduction bill, may agree with the GAO opinion that DOE's obligation to recover costs has not been adequately addressed. Finally, opposition may arise from representatives who will try to use the opportunity to attack DOE on issues ranging from the shutdown of enrichment plants, the abandonment of centrifuge enrichment technology, non-proliferation, or sanctions against other nations.

Compounding DOE's problems, a legal opinion issued on February 19, 1986 by the GAO stated, "... whatever the policy merits of (Department of) Energy's proposal, it cannot legally be accomplished through rulemaking." The GAO specifically took issue with three aspects of the proposed criteria:

— The modification that allows DOE flexibility in pricing and other contract terms without congressional oversight;

— the changes that permit individually negotiated contracts rather than standard contracts; and

— the "Nondiscrimination" criteria.

In addition, the opinion expressed doubt that DOE has correctly and sufficiently addressed the problem of the viability of the US uranium industry in its proposed criteria. The GAO recognized some merit in the proposal, but judged that the changes conflict with established law and must be implemented through legislative action.

Conclusions

Despite statements to the contrary, DOE's credibility has increasingly come into question. The US uranium producers' lawsuit was characterized by DOE as being without merit, yet the Court ruled the USEC null and void. DOE resisted the establishment of new enrichment criteria on the theory that such new criteria would constitute an admission that the implementation of the USEC was in fact flawed. The US Court of Appeals in Denver, which is currently reviewing the judgment against DOE, recently denied a motion that would have nullified the original invalidation of the USEC upon acceptance of the new criteria. The GAO in turn found that the new criteria were illegal.

A number of DOE customers, while impressed by its commercial orientation, are dismayed both by the confusion and lack of preparation now evident and have understandably formed the impression that DOE is merely reacting to events beyond its

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control. While the proposed changes to the enrichment criteria would give DOE new flexibility to operate in a competitive market environment, customers have little knowledge as to how this flexibility will be utilized once they have committed 100 percent of requirements to DOE for the next decade. Many of DOE's customers, particularly in the USA, believe that it was only the pressures of secondary market sales, Eurodif, and Urenco that forced DOE to respond with more competitive measures in the first place. Thus, many utilities fear that DOE's reestablishment of a strong competitive position, one in which market forces can no longer exercise disciplinary power over DOE's activities, will allow it to once again control the enrichment market.

Indeed, there are indications that DOE will improve its market position *despite* the recent uncertainties. The two incentive pricing initiatives, the weakening of the US dollar against most European currencies, and the provisions for additional contract flexibility contained in the proposed new criteria all combine to strengthen DOE's position. The range of possible resolutions to the legal and procedural difficulties could be far-reaching.

One extreme scenario involves the Court ruling against DOE on all counts, denying appeals, and immediately barring the enrichment of non-US origin uranium for domestic end use. The results would be chaotic for DOE, and particularly for its domestic customers. The opposite extreme involves the acceptance of the new criteria unchanged; DOE would prevail in the courts and no relief would be granted to US producers concerning the import issue. It is unlikely that either scenario will materialize; rather, the most likely outcome will entail a degree of compromise. Although the eventual resolution is impossible to predict, it is certain to affect both the enrichment and uranium markets worldwide.

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CURRENT MARKET DATA

February 28, 1986	Market Values	Active Supply[1] (thousands)	Active Demand[1] (thousands)
EXCHANGE VALUE	**\$17.00**/lb. U_3O_8	2,405	975
UF$_6$ VALUE	**\$48.00**/kgU		
CONVERSION VALUE	**\$1.80**/lb. U as UF$_6$	865	950
SWU VALUE 0.3 tails assay; delivery within one year	**\$80**/SWU		
LOAN RATE	5%/annum	0	0

	\$/lb. U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
TRANSACTION VALUE	**16.70**	2.6	16	5

[1] Supply and demand tables in *Current Market Data* section of this Report detail the numbers for each category.

DEFINITIONS

1. The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.
2. The **UF$_6$ Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.
3. The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.
4. The **SWU Value** represents Nuexco's judgment of the price at which transactions for the sale of significant quantities of SWUs of stated origin for delivery in the specified time period could be concluded as of the date indicated.
5. The **Loan Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.
6. The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
   a. Transactions closed within the previous three-month period for which delivery is scheduled within one year of the transaction date;
   b. At least ten transactions;
   c. Transactions involving a sum total of at least 2 million pounds U_3O_8 equivalent.

   The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

DERIVATIONS AND COMMENTS

1. All Market Values are based on:
   a. Data from recently completed transactions.
   b. Data from pending transactions.
   c. Firm bids to buy or borrow, and firm offers to sell or lend.
   d. Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell or lend.
2. Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these Market Values.
3. In the determination of the Conversion Value, Nuexco does not consider transportation charges other than those customarily provided by primary suppliers of conversion services.
4. The prices of conversion services or SWUs delivered under long-term contracts with primary suppliers are not considered in the determination of either the Conversion Value or SWU Value.
5. For the SWU Value, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight-percent U_{235} and a product assay of 3.0 weight-percent U_{235}, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
6. In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

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CURRENT MARKET DATA

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
Country (currency)	This Month (Feb 28, 1986)	Last Month (Jan 31, 1986)	12 Months Ago (Feb 28, 1985)	This Month (Feb 28, 1986)	Last Month (Jan 31, 1986)	12 Months Ago (Feb 28, 1985)
Australia (dollar)	23.97	23.74	20.76	62.31	61.71	53.97
Belgium (comm. franc)	771.68	828.06	1,001	2,006	2,153	2,602
Canada (dollar)	23.98	[illegible].14	20.73	62.35	62.75	53.89
Finland (markka)	86.03	90.62	103.38	223.66	235.59	268.76
France (franc)	116.20	123.82	152.39	302.09	321.90	396.19
FRG (mark)	37.89	40.38	49.85	98.50	104.98	129.60
Italy (lira)	25,668	27,557	30,902	66,731	71,642	80,339
Japan (yen)	3,082	3,275	3,881	8,012	8,514	10,090
Netherlands (guilder)	42.67	45.70	56.24	110.93	118.81	146.22
South Africa (rand)	33.73	38.72	30.00	87.69	100.67	77.99
Spain (peseta)	2,380	2,548	2,745	6,187	6,625	7,137
Sweden (krona)	121.69	127.63	140.71	316.37	331.80	365.82
Switzerland (franc)	32.00	34.29	42.37	83.20	89.14	110.16
UK (pound)	11.58	12.02	13.76	30.11	31.25	35.78
US (dollar)	17.00	17.00	15.00	44.20	44.20	39.00

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
Country (currency)	This Month (Feb 28, 1986)	Last Month (Jan 31, 1986)	12 Months Ago (Feb 28, 1985)	This Month (Feb 28, 1986)	Last Month (Jan 31, 1986)	12 Months Ago (Feb 28, 1985)
Australia (dollar)	23.54	23.11	21.73	61.21	60.08	56.49
Belgium (comm. franc)	758.06	806.14	1,047	1,971	2,096	2,723
Canada (dollar)	23.56	23.50	21.70	61.25	61.09	56.41
Finland (markka)	84.51	88.22	108.20	219.72	229.35	281.30
France (franc)	114.15	120.54	159.50	296.76	313.37	414.68
FRG (mark)	37.22	39.31	52.18	96.76	102.20	135.65
Italy (lira)	25,215	26,828	32,344	65,554	69,746	84,088
Japan (yen)	3,028	3,188	4,062	7,871	8,289	10,561
Netherlands (guilder)	41.92	44.49	58.87	108.98	115.66	153.04
South Africa (rand)	33.13	37.70	31.40	86.14	98.01	81.63
Spain (peseta)	2,338	2,481	2,873	6,078	6,450	7,470
Sweden (krona)	119.54	124.25	147.28	310.78	323.02	382.89
Switzerland (franc)	31.44	33.38	44.35	81.73	86.78	115.30
UK (pound)	11.38	11.70	14.40	29.58	30.42	37.45
US (dollar)	16.70	16.55	15.70	43.42	43.03	40.82

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on February 28, 1986.

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CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U as UF_6			per kg. U as UF_6		
Country (currency)	This Month (Feb 28, 1986)	Last Month (Jan 31, 1986)	12 Months Ago (Feb 28, 1985)	This Month (Feb 28, 1986)	Last Month (Jan 31, 1986)	12 Months Ago (Feb 28, 1985)
Australia (dollar)	2.54	2.23	1.38	5.59	4.93	3.05
Belgium (comm. franc)	81.71	77.93	66.71	180.13	171.82	147.07
Canada (dollar)	2.54	2.27	1.38	5.60	5.01	3.05
Finland (markka)	9.11	8.53	6.89	20.08	18.80	15.19
France (franc)	12.30	11.65	10.16	27.12	25.69	22.40
FRG (mark)	4.01	3.80	3.32	8.84	8.38	7.33
Italy (lira)	2,718	2,594	2,060	5,992	5,718	4,542
Japan (yen)	326.32	308.23	258.73	719.42	679.52	570.41
Netherlands (guilder)	4.52	4.30	3.75	9.96	9.48	8.27
South Africa (rand)	3.57	3.64	2.00	7.87	8.04	4.41
Spain (peseta)	252.00	239.84	183.02	555.55	528.77	403.48
Sweden (krona)	12.88	12.01	9.38	28.41	26.48	20.68
Switzerland (franc)	3.39	3.23	2.82	7.47	7.11	6.23
UK (pound)	1.23	1.13	0.92	2.70	2.49	2.02
US (dollar)	1.80	1.60	1.00	3.97	3.53	2.20

SWU VALUE AND UF_6 VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	SWU Value delivery within one year (February 28, 1986)	UF_6 Value per kg.U in UF_6 This Month (February 28, 1986)	UF_6 Value per kg.U in UF_6 Last Month (January 31, 1986)
Australia (dollar)	112.79	67.67	65.62
Belgium (comm. franc)	3,631	2,179	2,289
Canada (dollar)	112.87	67.72	66.73
Finland (markka)	404.86	242.91	250.53
France (franc)	546.82	328.09	342.32
FRG (mark)	178.29	106.98	111.64
Italy (lira)	120,791	72,475	76,187
Japan (yen)	14,503	8,702	9,054
Netherlands (guilder)	200.80	120.48	126.34
South Africa (rand)	158.73	95.24	107.06
Spain (peseta)	11,200	6,720	7,045
Sweden (krona)	572.66	343.59	352.85
Switzerland (franc)	150.60	90.36	94.80
UK (pound)	54.50	32.70	33.23
US (dollar)	80.00	48.00	47.00

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on February 28, 1986.

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CURRENT MARKET DATA

RECENT TRANSACTIONS[1]

Uranium Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price as Percent of Current Exchange or UF_6 Value	Seller	Buyer	Remarks
3685	1986	50-100	102	Trader	Non-US Utility	UF_6. Part of tails assay swap.
3684A	1986	301-600	R[5]	European Utility	European Utility	Contained in LEU.
3683	1987	101-300	103	R[5]	European Utility	
3681	1986	less than 50	101	US Producer	Trader	
3654	1986	101-300	see remarks	R[5]	US Utility	Market related price. – Transaction occurred in late 1985.

Enrichment Services
Secondary Market Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity[2] (thousands of SWUs)	Approximate Price[3] as Percent of Current SWU Value[4]	Seller	Buyer	SWU Origin	Remarks
3688	1986	less than 50	113	US Utility	US Fabricator	DOE	
3687	1986	less than 50	R[5]	US Utility	US Utility	DOE	
3686	1986	less than 50	99	Non-US Utility	Non-US Utility	DOE	Tails assay swap.
3684B	1986	101-300	R[5]	European Utility	European Utility	R[5]	Contained in LEU.

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[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] If tails assay is unknown or unspecified, Nuexco's calculation of SWU quantity assumes 0.20 w/o tails assay.

[3] Price is not normalized to 0.20% tails assay.

[4] Refers to SWU Value that corresponds to SWUs included in transaction. When prices and SWU values are expressed as discounts (e.g. X dollars less than DOE's USEC base price at time of delivery), the percentage refers to the ratio of the *discounts*, not the ratio of the prices.

[5] The notation *R* means that Nuexco either does not know, or that Nuexco has restricted that information to protect client confidentiality.

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URANIUM SUPPLY
(February 28, 1986)

	Delivery Period[1] (Thousands of Pounds U_3O_8)		
Nuexco Project Number	**Spot or Near-term[2]**	**Intermediate or Long-term**	**Remarks**
Available for Sale:			
ACTIVE			
2335	300	—	
2728	350	—	
2740	175	—	
2793*	500	—	
2802*	200	—	UF_6
2838*	130	—	UF_6
3023	750	500	UF_6
2263		400 per year	1987 on
2625	—	500 per year	1987 on
2778	—	220 per year	1987-90
2781	—	100 per year	1988-95
TOTAL	2,405		
INACTIVE			
2336	250	250 per year	1986-94
2389	75	75 per year	1986-90
2764	260	—	UF_6
2765	260	—	UF_6
2777	250	—	
2851*	125	—	
2297	—	200 per year	1986-89
TOTAL:	1,220		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2654, 2680, 2818.

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CURRENT MARKET DATA

URANIUM DEMAND
(February 28, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or long-term	Remarks
Inquiries to Purchase: ACTIVE			
2786	60	—	
2811*	65	—	UF_6
2820*	200	—	UF_6
2888	650	—	
2217	—	1,000 per year	1989-95
2507	—	600	1987-89
2586	—	250 per year	1988-95
2681	—	500 per year	UF_6 or U_3O_8; 1987-88
2738	—	1,000	1989 on
2739	—	1,000 per year	1987-90
2760	—	750 per year	1986-90
2770	—	500 per year	1988-94
2782	—	800	1987-88
2808	—	300	1987 on
2821	—	120 per year	1988-93
2850	—	300 per year	1990-95
2870	—	100	1989
TOTAL:	975		
INACTIVE			
2548	290	—	
2733*	500	500 per year	1987-95
2743*	600	—	UF_6
2784	100	—	
2798	70	—	
2806	1,000	—	
TOTAL:	2,560		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2758.

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LOAN SUPPLY AND DEMAND
(February 28, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Within 1 Year	Beyond 1 Year	Remarks
Available for Loan:			
INACTIVE			
1938	2,000	—	UF_6
2036	500	—	
2667	800	—	
2805	2,000	—	
TOTAL:	5,300		

*New or revised since last month.

[1] Measured from the date of this Report.

Projects removed since last month: None.

No inquiries to borrow are reported this month.

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CURRENT MARKET DATA

CONVERSION SUPPLY AND DEMAND
(February 28, 1986)

	Delivery Period[1] (Thousands of Pounds U as UF_6)		
Nuexco Project Number	**Within 3 Years**	**Beyond 3 Years**	**Remarks**
Available for Sale:			
ACTIVE			
2717*	290	—	
2849	300	900	1986-90
2874	275	—	
TOTAL:	865		
Inquiries to Purchase:			
ACTIVE			
2833*	400	—	
2865*	450	—	
TOTAL:	950		
INACTIVE			
2864*	330	—	
2882	—	1,000	1987
TOTAL:	330		

*New or revised since last month.

[1] Measured from the date of this Report.

Projects removed since last month: 2724.

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SWU SUPPLY AND DEMAND
(February 28, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of SWUs) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
2571	—	55	1987
2873	40	—	
2889	25	—	
TOTAL:	65		
INACTIVE			
2410A	340	—	
2914*	50	—	
TOTAL:	390		
Inquiries to Purchase:			
ACTIVE			
2811*	10	—	
3024*	10	—	
TOTAL:	20		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes SWUs deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2705, 2761, 2797.

ANALYSIS & COMMENTARY

US NUCLEAR POWER PLANT BACKLOG

Construction Progress

Despite the slow construction progress of nuclear plants in the USA (surpassed by almost every nation having a substantial nuclear construction program), one promising development emerged in 1985. The rash of cancellations of partially constructed units over the past decade appears to have waned; no units were canceled in 1985, the first time that has happened since 1973. Thirty-four units comprise the nuclear plant construction backlog in the USA as of February 1986. A unit enters the backlog when construction starts and exits when commercial operation begins. Table 1 lists the units currently under construction and on order, in descending order of construction completion percentage, including units for which the expected date of commercial operation is indefinite. The units represent a total capacity of approximately 38,000 MWe. Recent trends indicate that most of the units currently under construction could be operable by 1990.

Table 1 lists the completion percentage for each unit in January 1984 and in January 1986, and uses that percentage change as a measure of progress. Table 2 then shows a breakdown of the construction progress for all of the units, placing them into a series of ten-percent ranges. Only seven of the units in the backlog exhibited more than 20 percent progress in the two-year span; even more discouraging are the many units measuring less than five percent or negative progress over the two years. Part of this problem can be attributed to lengthy licensing procedures as a unit approaches commercial operation, but the uncertain financial situations of some nuclear utilities probably accounts for most of the stagnation.

Table 2

CONSTRUCTION PROGRESS ON US BACKLOG BETWEEN JAN. 1984 AND JAN. 1986 (As measured by changes in completion percentages)

Change in Completion Percentage[1]	Number of Units[2]
40-49	1
30-39	3
20-29	3
10-19	11
0-9	14
negative	2
TOTAL	34

[1] As listed in Table 1 of this article.

[2] Excludes two units (Commonwealth Edison's Carroll County Units 1 and 2) which are on order.

Outlook for Near-Term Growth

Table 3 presents a breakdown of the units under construction according to completion percentage. The table illustrates that over half of the units on backlog (representing almost 20,000 MWe) are at least 90-percent complete, an encouraging sign for growth in installed nuclear capacity over the next several years. Eight of those units are 100-percent complete and are licensed for various stages of power ascension. A notable example is Arizona Public Service Company's Palo Verde plant. Unit 1 began commercial operation in February 1986, and Unit 2 has been licensed to load fuel. The utility expects that unit to enter commercial operation later in 1986, with Unit 3 signalling the plant's completion in mid-1987.

Table 3

COMPLETION PERCENTAGES OF UNITS IN US BACKLOG

Percent Complete[1]	Number of Units[2]
90-100	18
80-89	5
70-79	2
60-69	2
50-59	4
40-49	0
30-39	2
20-29	1
10-19	0
0-9	0
TOTAL	34

[1] As listed in Table 1 of this article.

[2] Excludes two units which are on order.

Other units approaching completion, such as Long Island Lighting Company's (LILCO) Shoreham plant, may be further from actual commercial operation than indicated by their construction completion percentage. The Shoreham unit remains entangled in various legal proceedings associated primarily with the issue of emergency evacuation plans. Because of the unknown length of the current proceedings, it is difficult to

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Table 1

US NUCLEAR POWER PLANT BACKLOG[1]

Unit	Lead Utility	MWe (net)	Completion Percentage		Change in Completion Percentage
			Jan. 1984[2]	Jan. 1986[3]	
Under Construction					
Fermi 2	Detroit Edison	1100	98	100	2
Diablo Canyon 2	Pacific G&E	1106	95	100	5
River Bend 1	Gulf States Util.	940	82	100	18
Palo Verde 2	Arizona PS	1270	99	100	1
Perry 1	Cleveland Elec.	1205	90	100	10
Hope Creek 1	Public Service E&G	1070	81	100	19
Catawba 2	Duke Power Co.	1145	62	100	38
Shoreham*	LILCO	809	99	100	1
Millstone 3	Northeast Utilities	1150	81	99	18
Comanche Peak 1	Texas Utilities	1150	97	99	2
Watts Bar 1	Tennessee Valley Auth.	1177	96	99	3
Palo Verde 3	Arizona PS	1270	83	99	16
Clinton 1	Illinois Power Co.	933	82	98	16
Nine Mile Pt. 2	Niagara Mohawk	1085	78	95	17
Seabrook 1	Yankee (New Hampshire)	1150	89	95	6
Shearon Harris	Carolina Power & Light	900	85	94	9
Beaver Valley 2	Duquesne Light Co.	833	78	90	12
Braidwood 1	Commonwealth Edison	1120	70	90	20
Vogtle 1	Georgia Power Co.	1100	61	89	28
Watts Bar 2	Tennessee Valley Auth.	1177	61	85	24
South Texas 1	Houston Light & Power	1250	50	83	33
Bellefonte 1	Tennessee Valley Auth.	1213	76	83	7
Byron 2	Commonwealth Edison	1120	67	82	15
Comanche Peak 2	Texas Utilities	1150	65	78	13
WPN-3*	Washington PPSS	1240	75	75	0
South Texas 2	Houston Light & Power	1250	25	65	40
WPN-1*	Washington PPSS	1240	63	63	0
Braidwood 2	Commonwealth Edison	1120	54	59	5
Perry 2*	Cleveland Electric	1205	42	57	15
Bellefonte 2	Tennessee Valley Auth.	1213	57	54	−3
Vogtle 2	Georgia Power Co.	1100	20	53	33
Grand Gulf 2*	Mississippi P&L	1250	33	33	0
Limerick 2	Philadelphia Electric	1055	30	31	1
Seabrook 2*	Yankee (New Hampshire)	1150	29	23	−6
TOTAL		38,246			12[4]
On Order					
Carroll County 1	Commonwealth Edison	1120	0	0	—
Carroll County 2	Commonwealth Edison	1120	0	0	—

*Commercial operation date is indefinite.

[1] Excludes two units (Limerick Unit 1 and Palo Verde Unit 1) which began commercial operation in early 1986.

[2] As listed in *Nuclear News* "World List of Nuclear Power Plants" of December 31, 1983, and other publications.

[3] As listed in *Nuclear News* "World List of Nuclear Power Plants" of December 31, 1985, and other publications.

[4] Indicates a megawatt-weighted average, i.e. the average change in completion percentage for units under construction during the two-year period from January 1984 to January 1986, incorporating an adjustment for differences in the size of those units.

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predict the unit's eventual operation date. In general, the likelihood of unanticipated problems and slow licensing procedures for many of the twenty-odd units nearest to operation will prevent a rapid increase in capacity in 1986. Nuexco projects that 7 of the 18 units scheduled to enter commercial operation in 1986 will actually do so. Moreover, Duke Power Company's Catawba Unit 2, which had been scheduled for operation in June 1987, has just completed fuel loading and probably will enter commercial operation in the fourth quarter of 1986.

Table 3 also demonstrates that the surge of reactor programs initiated in the mid-1970s is reaching its final stage. Commercial operation is uncertain for many of the units which are less than 70-percent complete. The Seabrook and Grand Gulf plants are typical examples; in each case, the financial burden associated with construction of the first unit has drastically reduced the chances of obtaining financing to finish the second unit. The progress on Seabrook Unit 2 and Grand Gulf Unit 2 was zero or less during the two-year span.

Table 4 summarizes nuclear construction programs in the USA. Overall, while the average percentage progress made on backlog (measured against other nations) probably will not improve significantly, the steady progress utilities have made in bringing reactors to commercial operation over the last two years is likely to continue through 1986.

Table 4

US UTILITIES' NUCLEAR POWER PLANT CONSTRUCTION PROGRAMS

Units Under Construction	MWe Under Construction	Average MWe per Unit	Average Progress on Backlog[1]	Units On Order
34	38,246	1,125	12%	2

[1] Average progress on backlog measures the average change in completion percentage for units under construction during the two-year period from January 1984 to January 1986, incorporating a MWe-weighted adjustment for differences in the size of those units. The calculation excludes units on order and units that began commercial operation during that period.

AMPLIFICATIONS

Two typographical errors in the last two Reports warrant correction.

1. In Report 209 (January 1986), an article in the *PRICING* section discussed the recent DOE Incentive Pricing proposal for fiscal years 1991-1995. In it, the price per SWU under the offer was described as:

> "...the lower of the USEC price or the price determined by the following formula:
>
> $$\text{Price} = \$85 = \frac{(85)(\text{Im} - \text{I})}{\text{I}}, \text{ where}$$
>
> Im = Implicit Price Deflator for the US GNP (Gross National Product) at the end of the second quarter of the calendar year preceding the fiscal year of delivery.
>
> I = 230.55, which is the Implicit Price Deflator for US GNP for the second quarter 1985."

The equation as written produces only the fraction that should be *added* to $85 to determine the actual price; that fraction is *not* equal to $85. Therefore, the following equation can be used to determine the price by adding the fraction to $85:

$$\text{Price} = \$85 + \frac{(85)(\text{Im} - \text{I})}{\text{I}}$$

This can also be written:

$$\text{Price} = \$85 \times \left(1 + \frac{\text{Im} - \text{I}}{\text{I}}\right)$$

2. In Report 210 (February 1986), the article on the non-US nuclear plant backlog included an incorrect figure for the construction completion percentage of the Brokdorf unit in the Federal Republic of Germany, which was listed as only 15 percent complete as of January 1986. In actuality, the unit is 100-percent complete and is undergoing testing. The unit's lead utility and fuel buyer, Preussenelektra AG, expects the Kraftwerk Union PWR to enter commercial operation in August 1986.

3. Also in Report 210, in the article on 1985 US Uranium Activities, a reference to the April 1985 Nuexco Exchange Value stated that $14.25 was the lowest figure recorded in Exchange Value history. In actuality, it was the lowest figure *in over a decade*, but the all-time low was $5.95, which was in effect from mid-1971 through early 1973.

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WORLD URANIUM RESOURCES

Summary

Nuexco's estimate of the WOCA[1] uranium *resources* (recoverable at costs up to $50 per pound U_3O_8) is presented in Table 5. Defining "reserves" as reasonably assured resources (RAR[2]) recoverable at a cost of less than US$30 per pound U_3O_8 (RAR30), Nuexco estimates that the world's *reserves* amount to almost 2,000,000 short tons U_3O_8 (4,000,000,000 pounds U_3O_8). That amount, according to current estimates of reactor demand and without making any allowance for future uranium discoveries, would be sufficient to supply the world's requirements for at least the next 30 years.

Table 5

WORLD URANIUM RESOURCE ESTIMATE — REASONABLY ASSURED RESOURCES[1,2]
as of January 1, 1986
(Thousands of Short Tons U_3O_8)

	Recoverable at Cost of		
Region	**Less Than US$30/lb. U_3O_8**	**US$30 to US$50/lb. U_3O_8**	**Less Than US$50/lb. U_3O_8**
Argentina	23.6	5.8	29.4
Australia	592.0	82.0	674.0
Brazil	210.8	—	210.8
Canada	186.5	77.0	263.5
France	60.7	14.7	75.4
Gabon	12.4	6.0	18.4
India	41.2	14.3	55.5
Namibia	145.0	20.8	165.8
Niger	192.4	—	192.4
South Africa	221.0	158.6	379.6
Spain	19.8	6.0	25.8
United States	174.5	373.5	548.0
Other Countries	60.0	82.0	142.0
TOTAL	1,939.9	840.7	2,780.6

[1] Data from public sources, as modified by Nuexco to account for changes that have taken place since official estimates were released. Estimates for CMEA (Centrally-Planned Economic Areas) countries not included.

[2] Reasonably Assured Resources (RAR) refers to uranium that occurs in known mineral deposits of such size, grade and configuration that it could be recovered within the given production cost ranges with currently proven mining and processing technology. Estimates of tonnage and grade are based on specific sample data and measurements of the deposits and on knowledge of deposit characteristics. Reasonably Assured Resources having a high assurance of existence and in the cost category below $30/lb. U_3O_8 are considered as reserves for the purposes of this table.

Broadening the definition of reserves to include resources recoverable at less than US$50 per pound U_3O_8 would increase the total by approximately 40 percent, to 2,800,000 short tons U_3O_8 (5,600,000,000 pounds U_3O_8). That amount would supply world consumption for another 15 years, totaling 40 to 50 years forward supply based on current estimates without allowance for future discoveries. These resource totals include conventional deposits plus South African by-product mines. The world's estimated uranium resource endowment can be further increased by the inclusion of resources associated with unconventional sources, such as the following:

1. Heap leaching;
2. In-situ leaching;
3. By-product recovery from phosphoric acid;
4. Processing of slimes in South Africa;
5. Laser enrichment of enrichment plant tails.

Methodology

The Nuexco estimate of RAR is based on the definitions accepted by the International Atomic Energy Agency (IAEA) and the Organization for Economic Cooperation and Development (OECD). In short, RAR includes: "uranium that occurs in known mineral deposits of such size, grade and configuration that it could be recovered within a production cost range of less than US$30 per pound U_3O_8, with currently proven mining and processing technology."

The IAEA/OECD further defines RAR as having a high assurance of existence within the specified cost range. RAR classified in this manner are considered ore reserves, which is consistent with the USDOE classification for ore reserves. The cost ranges used herein are forward production costs (except as specified otherwise), defined both by IAEA/OECD and by USDOE as:

> "all capital and operating expenditures incurred after the date of the ore reserve estimate. Sunk costs are not included."

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[1] WOCA = World Outside Centrally-planned economic Areas.

[2] Reasonably Assured Resources (RAR) refers to uranium that occurs in known mineral deposits of such size, grade and configuration that it could be recovered within the given production cost ranges with currently proven mining and processing technology. Estimates of tonnage and grade are based on specific sample data and measurements of the deposits and on knowledge of deposit characteristics. Reasonably Assured Resources having a high assurance of existence and in the cost category below $30/lb. U_3O_8 are considered as reserves.

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Discussion

A large portion of the total uranium resource base was discovered during the 1970s and early 1980s, when increasing uranium demand seemed assured by the prevailing projections of nuclear power growth. This situation resulted in a vast increase in resource discoveries and the overdevelopment of supply capabilities. As the price of uranium concentrates increased, so did resource figures; lower-grade material was assigned to higher-cost and more speculative occurrence categories. Because uranium demand projections have diminished and supply has increased, uranium resources other than those in the RAR30 category should no longer be counted among the world's current reserves. Due to continual changes in industry economics, there are *some* portions of existing RAR30 that have yet to be reclassified into a higher cost category. This assessment includes all resources recoverable at costs up to $50 per pound U_3O_8 (RAR50), because Nuexco price forecasts indicate that resources in the RAR50 category will be relevant to uranium supply over the very long term (40 to 50 years). Beyond that period, new discoveries and changing economics will be important factors in establishing resource availability. The OECD/IAEA classification of Estimated Additional Resources (EAR) Categories 1 and 2 could potentially satisfy the longer-term requirement.

Because Estimated Additional Resources — Category 1[3] (EAR-1) consists of resources that have been discovered but not fully delineated, there is significantly less emphasis on resource validity, regardless of the close geologic association with RAR. EAR-2 consists of resources that potentially exist in association of known deposits and mineral trends, but have not yet been discovered. The potential status of EAR-1 for WOCA countries is shown in Table 6. EAR-1 resources add approximately 40 to 50 years to WOCA uranium supplies.

The RAR estimates listed for Australia, Canada, France, Gabon, Namibia, Niger, South Africa and the United States are the most valid, based upon historical exploration and mining data. Although some reclassification may become necessary to properly reflect changes in cost structures, there will be no attempt herein to reclassify resources. Officially, that will be done by each country over time according to applied technical interpretation of resources within each country. The potential variance attributable to this factor is less than five percent of the total.

Australia

The source for the official estimate for Australia was *"Uranium Mining — The Australian Environment,"* by P.J. Bradfield, AIF Symposium, Santa Fe, New Mexico, October 1,

Table 6

WORLD ESTIMATED ADDITIONAL RESOURCES — CATEGORY 1[1]
as of January 1, 1986
(Thousands of Short Tons U_3O_8)

	Recoverable at Cost of		
Region	**Less Than US$30/lb. U_3O_8**	**US$30 to US$50/lb. U_3O_8**	**Less Than US$50/lb. U_3O_8**
Australia	338.0	152.0	490.0
Brazil	120.0	—	120.0
Canada	136.5	119.6	256.1
France	34.5	8.2	42.7
India	6.2	19.0	25.2
Namibia	39.0	29.8	68.8
Niger	313.5	71.5	385.0
South Africa	128.7	54.6	183.3
United States[3]	659.0	503.0	1,162.0
Other Countries	35.0	144.0	179.0
TOTAL	1,810.4	1,101.7	2,912.1

[1] Data from public sources, as modified by Nuexco to account for changes that have taken place since official estimates were released. Estimates for CMEA (Centrally-Planned Economic Areas) countries not included.

[2] Estimated Additional Resources — Category 1 (EAR-1) refers to uranium in addition to RAR that is expected to occur, mostly on the basis of direct geological evidence in extensions of well-explored deposits and in deposits in which geological continuity has been established but where specific data and measurements of the deposits and knowledge of the deposits' characteristics are considered to be inadequate to classify the resource as RAR. Such deposits can be delineated and the uranium subsequently recovered, all within the given cost ranges. Estimates of tonnage and grade are based on such sampling as is available and on knowledge of the deposit characteristics as determined in the best-known parts of the deposit or in similar deposits. Less reliance can be placed on estimates in this category than on those for RAR.

[3] According to IAEA classification, these reserves exist as Category 2 reserves. The US EIA does not differentiate between Categories 1 and 2.

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[3] Estimated Additional Resources — category 1 (EAR-1) refers to uranium in addition to RAR that is expected to occur, mostly on the basis of direct geological evidence in extensions of well-explored deposits and in deposits in which geological continuity has been established, but where specific data and measurements of the deposits and knowledge of the deposits' characteristics are considered to be inadequate to classify the resource as RAR. Such deposits can be delineated and the uranium subsequently recovered, all within the given cost ranges. Estimates of tonnage and grade are based on such sampling as is available and on knowledge of the deposit characteristics as determined in the best-known parts of the deposit or in similar deposits. Less reliance can be placed on the estimates in this category than on those for RAR.

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1985. From those figures Nuexco subtracted 10,000 tons to account for 1984 and 1985 production.

Australian resources, primarily in the $30 per pound category, are suspect because of various factors.

1. The presence of a limited industrial-support base;
2. A lack of product markets;
3. Complicated political and environmental constraints, and;
4. The favored deposits contain relatively low-grade uranium.

One exception may be the future production from the Olympic Dam project, where uranium recovery will be secondary to that of copper and gold. The total property resources are estimated at 468,000 tons U_3O_8; approximately 156,000 tons are included as RAR30. The remaining 312,000 tons are primarily distributed between RAR50 and EAR-1 cost categories.

Canada

The official resource estimate for Canada originated from "*Uranium in Canada: 1984 Assessment of Supply and Requirements*," Energy Mines and Resources Canada, September 1985. Nuexco reduced that amount by subtracting actual 1984 production, and 15,000 tons for estimated 1985 production.

Energy, Mines and Resources Canada (EMR) is the organization responsible for uranium resource appraisal. It reports uranium resources as the quantity of uranium recoverable from minable ore; thus, not all uranium associated with a particular deposit will necessarily be included in the RAR category. The present RAR total is based on this concept for all applicable resources known in Canada.

The vast majority of RAR resources are located in the northern Saskatchewan and Elliot Lake districts. Exploration success in northern Saskatchewan continues, suggesting that RAR will be increased further. In fact, the discovery rate for the area has far exceeded total production and reclassification by the EMR over the past few years.

The EAR30 estimate decreased sharply to 136,500 tons U_3O_8 from the 1983 estimate of 235,300 tons. New exploration information, based largely on the continuing evaluation of the Cigar Lake deposit, resulted in the reclassification of resources into the RAR30 and RAR50 categories. Also there was a decrease of about 36,000 tons U_3O_8 in resources assigned to the EAR-1 cost category. Additional changes in resource status will probably occur as the evaluation of Cigar Lake and other new discoveries continues.

South Africa

NUCOR (Nuclear Development Corporation of South Africa [Pty] Ltd.) in 1984 released an updated official assessment of South Africa's uranium resources and production capabilities. Although the release of such information is closely controlled in South Africa under the National Energy Act, the report contains some of the most comprehensive information ever published on the subject. Included were the latest official assessments of trends in uranium exploration, production and prices, as well as discussions of geology and national policy matters.

NUCOR periodically reassesses South Africa's uranium resource and production capabilities. It also expresses the total recoverable resources and their associated costs in terms of RAR and EAR. Nuexco used the NUCOR estimate (*Uranium in South Africa*, "1983 Assessment of Resources and Production," page 11, Nuclear Development Corporation of South Africa [Pty] Ltd.) and then adjusted the official figures to reflect actual production.

The quartz-pebble conglomerates in the Witwatersrand district are the main source of RAR in South Africa. The RAR total is geologically and technically tied to gold resources. Approximately 97 percent of South African uranium is produced at costs below $30 per pound as a by-product of gold production. The Palabora project produces the remaining 3 to 4 percent as a by-product of copper mining.

The recovery of uranium in South Africa is adapted to low grade, high volume operations which require efficient, low-cost control. Nuexco's estimate of production costs allocated to uranium is well below $30 per pound U_3O_8, both for newly mined ore and the recovery from tailings. It appears that the association of South African RAR with gold will cause total availability to remain high and will enable South Africa to sustain its historical market share of 14 to 16 percent.

The uranium resource base in South Africa is likely to remain consistent with the figures outlined in Tables 5 and 6. The only changes should be a slow depletion of reserves due to ongoing production. However, some reclassification of reserves from RAR30 to RAR50 or EAR-1 is possible, should decreasing gold prices or increasing production costs alter current gold production schedules. The recent devaluation of the rand could also trigger changes in gold production schedules. Nevertheless, the overall effect on uranium production costs would be minimal. Any changes applied to resources outside the Witwatersrand quartz-pebble conglomerates would have little impact on the overall resource status of South Africa.

United States

The source of the official estimate of US resources was "Uranium Industry Annual 1984," DOE/EIA—0478(84), page 36. Nuexco subtracted 5,000 tons as a 1985 production estimate. These figures do not include 54 million pounds of $30-per-pound reserves potentially available as by-product from the production of phosphates and leaching of copper dumps.

The USA can no longer be considered a major uranium resource country under existing conditions. The largest portion of RAR in the United States falls in the upper level of the $50 cost category, due to remaining resources that are essentially low-grade and costly to extract on a per-pound basis. Moreover, the Energy Information Administration (EIA) has established domestic economic reserves as that portion of RAR which includes all conventional and solution-minable uranium ore recoverable at or below specified production costs. EIA defines this as uranium that is recoverable at costs equal to or below the current market price (or existing contract price). Economic reserves are listed by the EIA at 100,000 tons U_3O_8. According to the EIA, the economic reserves are associated with projects now operating, in the planning stage, or on standby. Of the total economic reserves, 43 percent are located in New Mexico, 33 percent are in Texas and Wyoming, and the remaining 24 percent occur throughout the other districts.

A large part of RAR situated at the upper level of the $50 cost category might not to be recoverable at almost any cost. Of the 373,500 tons listed in that range, approximately 70 to 80 percent are located on properties that are either permanently or temporarily shut down. Conditions that lead to suspended operations continue to exist, and the probability of many of these properties ever reopening becomes more remote with time. Most of the US RAR in the $30 to $50 range will eventually be reclassified into an even higher cost category. It is likely that a portion of the RAR in the $30 or less cost category will be recovered, especially the higher grade reserves in New Mexico and northern Arizona, but the remaining portion might not be mined at all.

Reclassification of uranium resources began about 1980, the result of sharp decreases in the market price for uranium concentrates and escalating production costs. Many mine and mill closures followed, and the US uranium resource base began shifting to higher cost categories. In 1983, the EIA instituted new uranium resource classification categories in order to better approximate the IAEA classifications. Resources previously listed as "reserves" became *Reasonably Assured Resources*. Resources previously listed as "probable potential" were now listed as *Estimated Additional Resources*. However, Categories 1 and 2 of EAR were not recognized by the EIA because of its lack of confidence in the current resources reporting and tabulation system. Instead, US EAR merely represents resources potentially available within a $50 per pound cost range. Because of this distinction, the OECD/IAEA has included all US EAR into its EAR-2 category. Accordingly, the US EAR50 total approximately 1,162,000 tons U_3O_8 (Table 6), all of which OECD/IAEA lists as EAR-2. Thus, the US EAR account for almost 80 percent of EAR-2 resources among WOCA nations.[4] Most of the EAR occur in close relationship with the RAR located in New Mexico, Wyoming, Utah and Colorado.

Argentina, Brazil, Gabon, India, Namibia, Niger, and Spain

Nuexco used official estimates from *"Uranium Resources, Production and Demand,"* a joint report by OECD Nuclear Energy Agency and the International Atomic Energy Agency, December 1983, page 19. Nuexco subtracted production for 1983, 1984, and 1985.

Other Countries

Other countries include Algeria, Italy, Japan, Mexico, Portugal, Sweden and Zaire. Official resource estimates were obtained from the aforementioned OECD/IAEA report and were reduced by a total of 5,000 tons U_3O_8, representing combined production for 1983 through 1985. (Source for that production estimate was "United States Uranium Mining and Milling Industry," May 1984, DOE/S-0028, page 32.)

RAR listed for other countries are unreliable as valid uranium resources. Most occurrences are captive to domestic nuclear programs that have been abandoned or stalled indefinitely, and the need for uranium has passed. The deposits are small and low grade; in many cases, mining recovery has never been attempted. For this group, most RAR should be included in the upper part of the $50 cost category or reclassified into a higher cost category. However, the total for this category represents only slightly more than one year's consumption at current rates. Therefore, this category can be ignored without affecting the results of the analysis.

In most other countries, the reclassification of resources has had a negligible effect on WOCA totals. However, reclassification in France and Niger have significantly increased WOCA resource totals. The exploration effort within France is perhaps the most aggressive throughout WOCA nations. As a result of further evaluation of new discoveries, approximately 2,000 tons U_3O_8 have been added to RAR50, and about 12,000 tons have been added to EAR-1. In Niger, the continued reclassification has resulted in the addition of 41,000 tons U_3O_8 to RAR 50, and the addition of 244,000 tons U_3O_8 to EAR30.

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[4] "Nuclear Fuel Cycle Supply Capabilities — The Front End", by R.M. Williams of Energy, Mines and Resources Canada. Presented at the OECD/IAEA Conference in Paris, France, November 5-7, 1985.

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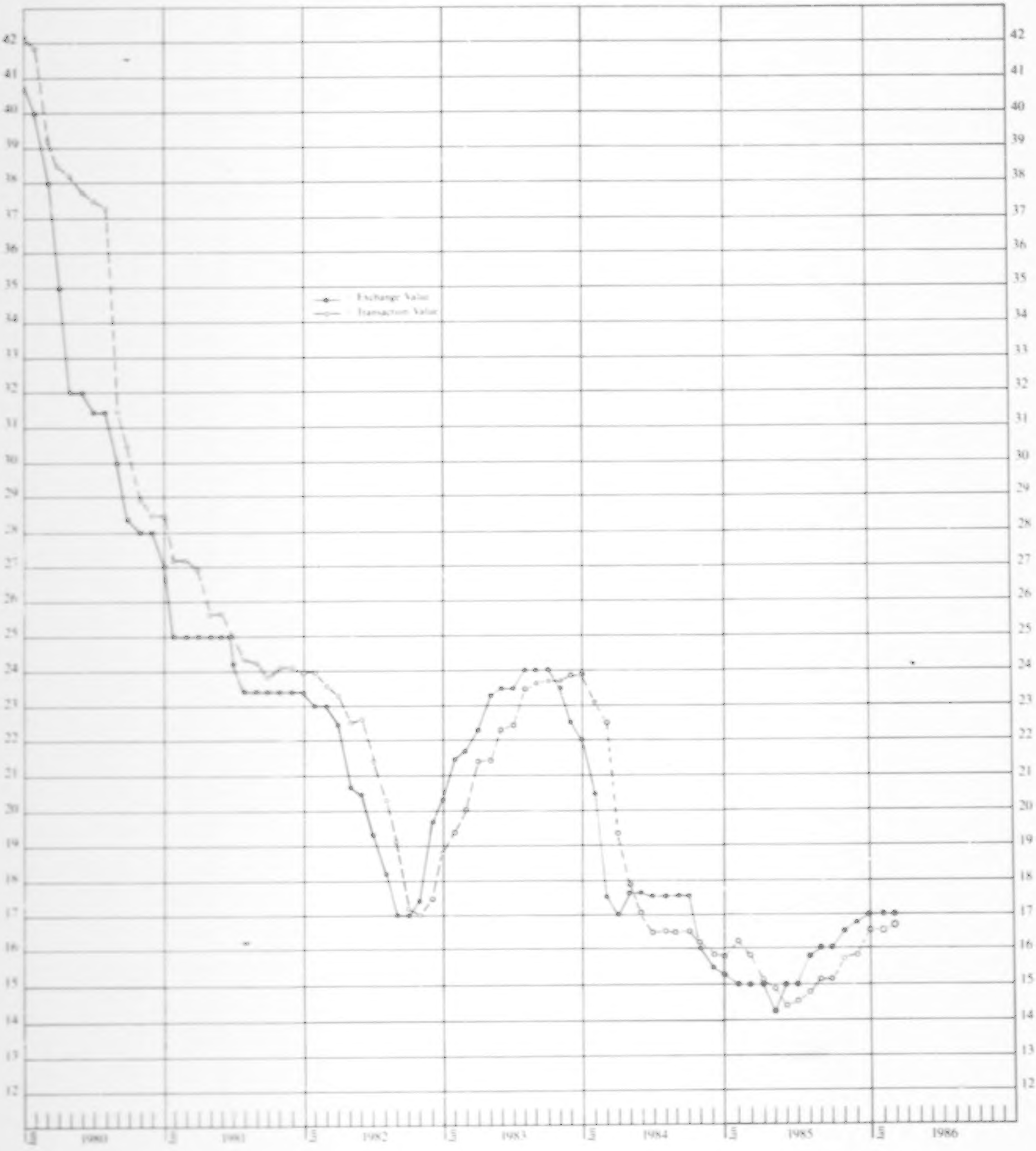
HISTORICAL MARKET DATA

EXCHANGE AND TRANSACTION VALUES SINCE JANUARY 1980

Determined as of the last day of the month indicated



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HISTORICAL MARKET DATA

HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	32.50	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	**17.00**										

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	**16.70**										

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U in UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	**1.80**										

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AUSTRALIA

	Price Index of Materials Used in Manufacturing Industry — All Groups[1] (1969 = 100)	Award Rates of Pay Indexes Australia — Adult Males In Mining Wage Earners, Weekly Rates[2] (1976 = 100)
1975 Avg.	150.4	132.6
1976 Avg.	168.4	160.9
1977 Avg.	192.0	179.0
1978 Avg.[3 4]	198.5	190.0
1979 Avg.	248.8	127.9
1980 Avg.	321.8	140.8
1981 Avg.	355.3	154.1
1982 Avg.[5]	368.6	174.9
1983 Avg.	401.2	181.8
Jan 1984	399.2	189.3R
Feb 1984	402.5	189.2R
Mar 1984	403.9	189.0R
Apr 1984	404.2	196.9R
May 1984	403.8	197.6R
Jun 1984	404.9	198.0R
Jul 1984	408.3	198.0R
Aug 1984	413.2	198.0R
Sep 1984	411.9	198.0R
Oct 1984	408.5	198.0R
Nov 1984	407.1	198.0R
Dec 1984	406.0	198.0R
FY84 Avg.[6]	402.1	—
FY85 Avg.[6]	422.2	—
Jan 1985	409.3	198.0R
Feb 1985	416.1	198.0R
Mar 1985	430.9	198.0R
Apr 1985	440.8	203.0R
May 1985	454.4	203.7R
Jun 1985	458.9	203.1R
Jul 1985	459.0	203.0R
Aug 1985	454.9	203.0R
Sep 1985	447.7	203.1R
Oct 1985	445.7	203.6R
Nov 1985	449.2	210.4
Dec 1985	—	210.5

P = Preliminary   R = Revised since last month

[1] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0).

[2] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

[3] Monthly data for 1970-78 appear on pages 4.7 and 4.8 of Report 138.

[4] Annual averages prior to 1979 reflect index base no longer in use.

[5] Monthly data for 1979-82 appear on page 35 of Report 184.

[6] Annual averages are for financial year ending June 30.

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GOVERNMENT STATISTICS

CANADA

	Industry Selling Price Index: Manufacturing[1] (1971 = 100)	Wage-earner Data: Average Hourly Earnings (C$)[2]					
		Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells[3] (SIC 051-099)	Primary Non-ferrous Metal Industries[4] (SIC 296)	(SIC 298)	Chemicals and Chemical Products[5] (SIC 370-379)
1979 Avg.[6]	217.9	—	9.60	9.66	—	—	7.67
1980 Avg.	247.2	—	10.58	10.80	—	—	8.50
1981 Avg.	288.7	—	12.02	12.23	—	—	9.53
1982 Avg.[7]	288.8	—	13.74	13.92	—	—	10.63
1983 Avg.	298.8	—	—	14.30	—	—	11.17
Jan 1984	305.4	17.74	15.27	14.74	11.91	10.84	11.69
Feb 1984	306.6	17.90	15.59	14.90	12.04	10.82	11.51
Mar 1984	308.7	18.05	15.52	14.82	12.14	10.84	11.58
Apr 1984	310.5	18.06	15.83	15.10	11.96	10.34	11.63
May 1984	310.6	18.48	15.64	15.06	12.11	10.16	11.65
Jun 1984	311.0	18.08	15.48	14.80	12.38	10.40	11.66
Jul 1984	312.9	17.81	15.72	14.92	12.53	10.18	11.82
Aug 1984	312.7	17.24	15.36	14.92	12.44	10.34	11.78
Sep 1984	312.3	17.68	15.96	15.34	12.51	10.52	11.90
Oct 1984	312.3	17.64	16.15	15.26	12.69	10.56	11.96
Nov 1984	313.6	18.04	16.13	15.43	12.47	10.51	11.96
Dec 1984	314.2	17.95	16.39	15.60	12.16	10.40	11.99
1984 Avg.	310.9	17.88	—	15.07	12.28	10.49	11.76
Jan 1985	315.9	18.05	16.13	15.60	12.32	10.80	12.04
Feb 1985	316.5	18.78	16.41	15.68	12.52	11.05	12.06
Mar 1985	318.0	18.24	16.21	15.57	12.44	10.97	12.02
Apr 1985	318.3	18.63	16.44	15.80	12.81	11.23	12.04
May 1985	318.8	19.41	16.51	15.63	12.76	11.25	12.15
Jun 1985	319.1	18.49	16.20	15.49	12.89	11.14	12.14
Jul 1985	319.3R	18.14	16.27R	15.41	12.96	11.17	12.13
Aug 1985	319.3R	17.07	16.03R	15.30	12.97	11.31	12.19
Sep 1985	319.6R	18.53	16.55	15.72	12.95	11.39	12.26
Oct 1985	320.8R	18.74	16.51	15.70	13.14	11.53	12.33
Nov 1985	321.8	19.05R	16.66R	15.88R	12.76R	11.32R	12.49R
Dec 1985	323.1	18.18P	16.56P	15.90P	12.43P	11.52P	12.65P

P = Preliminary   R = Revised since last month

[1] Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision.

[2] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours" (Catalogue 72-002).

[3] Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

[4] Beginning with the April 1983 figure, Primary Metal Industries, non-ferrous is split into SIC 296 and SIC 298.

[5] Chemical and Chemical Products prior to April 1983 was SIC 370-379. The new series is from a new survey which includes all companies and is based on a 1970 classification. The old survey only included companies of 20 employees or more.

[6] Monthly ISPI for 1977 and 1978 appear on page 4.10 of Report 138, and monthly wage-earner data for 1973-78 appear on page 4.11 of Report 138.

[7] Monthly data for 1979-1982 appear on page 37 of Report 184. On that page, the wage earner index entitled "Metal Mining, Including Milling (SIC 050-099)" should read "Total Mining (SIC 051-099)."

[8] Beginning with the April 1983 figure, Wage Earner Data are based on a census of all companies employing 200 or more wage earners, *plus* a random survey of companies employing fewer than 200 wage earners. Prior to April 1983 only companies employing 200 or more wage earners are included in the Wage Earner Data.

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REPUBLIC OF SOUTH AFRICA

		Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1]	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100)[2]	Consumer Price Index[3] (1980 = 100)[4]	Producer Price Index All Groups[5] (1980 = 100)	Total Employment in Mining and Quarrying (Code 35)[6]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[6]
1975	Avg.	16.71	—	157.2	100.0	639,473	1,003,617
1976	Avg.	19.30	—	174.7	115.1	671,240	1,212,983
1977	Avg.	23.87	—	194.4	130.0	712,006	1,420,670
1978	Avg.	27.14	—	137.2	142.7	664,571	1,537,169
1979	Avg.[7]	30.18	—	155.3	164.5	692,209	1,830,632
1980	Avg.[8]	35.53	—	176.7	192.1	714,379	2,279,615
1981	Avg.	41.89	—	206.5	218.3	728,506	2,820,505
1982	Avg.[9]	47.25	104.2	233.5	248.7	707,552	3,246,071
1983	Avg.	51.87	115.0	262.2	274.8	696,579	3,644,772
Jan	1984	—	—	274.7	283.3	689,807	326,619
Feb	1984	—	—	278.4	286.5	702,553	335,906
Mar	1984	55.30	123.1	281.9	288.0	715,628	342,332
Apr	1984	—	—	286.1	290.2	712,963	327,550
May	1984	—	—	288.3	292.6	710,040	327,937
Jun	1984	56.95	126.2	291.2	295.3	717,009	347,121
Jul	1984	—	—	295.1	296.0	717,121	369,964
Aug	1984	—	—	297.0	300.8	721,905	361,357
Sep	1984	60.64	133.2	299.9	304.1	721,470	359,218
Oct	1984	—	—	303.7	308.7	717,865	363,755
Nov	1984	—	—	307.4	312.8	717,396	369,771
Dec	1984	62.92	138.6	309.4	315.9	701,198	365,234
Jan	1985	—	—	177.1	166.6	711,366	376,777
Feb	1985	—	—	182.8	171.3	727,932	361,823
Mar	1985	64.48	142.4	183.6	173.0	708,809	371,380
Apr	1985	—	—	187.4	174.0	724,187	369,005
May	1985	—	—	189.5	177.7	708,085	373,478
Jun	1985	67.42	148.9	191.9	179.2	724,587	395,543
Jul	1985	—	—	193.6	180.7	738,228	419,106
Aug	1985	—	—	195.6	183.2	734,121	416,777
Sep	1985	70.47	155.3	197.8	184.8	732,836	419,883
Oct	1985	—	—	200.8	188.1	—	—
Nov	1985	—	—	203.4	196.0	—	—
Dec	1985	72.43	160.1	207.4	199.4	—	—
Jan	1986	—	—	213.8	—	—	—

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[1] Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly.

[2] Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

[3] Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."

[4] The basis for calculation prior to January 1985, 1975 = 100. For annual averages prior to 1978, April 1970 = 100.

[5] Previously known as the Wholesale Price Index, now the Producer Price Index. The computation remains the same. The basis for calculation prior to January 1985, 1975 = 100.

[6] Bulletin of Statistics, Department of Statistics, Pretoria.

[7] Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 4.9 of Report 140.

[8] Monthly data for Codes 35 and 40, 1977-1980, appear on page 28 of Report 157.

[9] Monthly data for 1979-82 appear on page 39 of Report 184.

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GOVERNMENT STATISTICS

UNITED STATES

	Producer Price Index[1]		Consumer Price Index[2]	GNP Implicit Price Deflator[3,4]	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[5]			
	Industrial Commodities (1967 = 100)	All Commodities (1967 = 100)	(1967 = 100)	(1982 = 100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980 Avg.[6]	274.8	268.8	246.8	178.64	10.26	10.63	8.30	6.94
1981 Avg.	304.1	293.4	272.4	195.51	11.55	11.98	9.12	7.62
1982 Avg.[7]	312.3	299.3	289.1	207.15	12.33	12.94	9.96	8.21
1983 Avg.	315.8	303.1	298.4	215.63	12.57	13.43	10.59	8.65
Jan 1984	319.1	308.0	305.2	—	12.68	13.37	10.88	8.91
Feb 1984	320.6	308.9	306.6	—	12.83	13.33	10.87	8.91
Mar 1984	321.9	311.0	307.3	106.6	12.89	13.32	10.96	8.94
Apr 1984	322.5	311.4	308.8	—	12.94	13.29	10.94	8.94
May 1984	323.3	311.7	309.7	—	13.02	13.36	11.99	8.94
Jun 1984	323.9	311.4	310.7	107.6	12.99	13.39	11.00	8.97
Jul 1984	324.0	312.0	311.7	—	13.06	13.34	11.09	9.00
Aug 1984	323.5	310.9	313.0	—	13.15	13.50	11.09	9.05
Sep 1984	322.3	309.5	314.5	108.6	13.23	13.38	11.20	9.13
Oct 1984	323.2	309.4	315.3	—	13.26	13.53	11.29	9.15
Nov 1984	323.8	310.4	315.3	—	13.27	13.74	11.31	9.20
Dec 1984	323.0	309.9	315.5	109.6	13.32	13.64	11.34	9.32
1984 Avg.	322.6	310.3	311.1	108.1	13.05	13.43	11.08	9.04
Jan 1985	322.9	309.5	316.1	—	13.29	13.70	11.39	9.33
Feb 1985	322.5	309.2	317.4	—	13.30	13.73	11.39	9.33
Mar 1985	322.6	308.7	318.8	110.4	13.29	13.95	11.37	9.39
Apr 1985	323.8	309.3	320.1	—	13.43	13.62	11.48	9.40
May 1985	325.3	309.8	321.3	—	13.24	13.59	11.46	9.39
Jun 1985	324.8	309.2	322.3	111.3	13.23	13.66	11.52	9.46
Jul 1985	324.4	309.0	322.8	—	13.45	13.82	11.60	9.47
Aug 1985	323.7	307.3	323.5	—	13.55	13.69	11.62	9.50
Sep 1985	322.2R	305.9R	324.5	112.1	13.44	13.66	11.67	9.55
Oct 1985	324.4	308.0	325.5	—	13.49	13.64	11.72	9.56
Nov 1985	325.0	309.7	326.6	—	13.49	13.95	11.82	9.61
Dec 1985	325.2	310.2	327.4	113.0	13.48P	13.76P	11.88R	9.70R
Jan 1986	324.0	309.0	328.4	—	—	—	11.89P	9.66P

P = Preliminary   R = Revised since last month

[1] US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

[2] US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items.

[3] US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted

[4] The basis for calculation of this index was revised to 1982 = 100. 1984 and 1985 figures have been adjusted to that basis. The basis for calculation prior to 1984, 1972 = 100.

[5] US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for 1977-1978 are adjusted to the March 1979 benchmark. Data for January 1979 and beyond are adjusted to the March 1980 benchmark.

[6] Monthly data 1970-1978 for Producer Price Index-Industrial Commodities, Consumer Price Index, and Employment and Earnings SIC codes 10, 333, and 28, and quarterly data for GNP Implicit Price Deflator appear on pages 4.6-4.8 of Report 139.

Monthly data 1977-1978 for Employment and Earnings SIC Codes 10, 333, and 28 appear on page 33 of Report 147.

Monthly data 1970-1978 for Employment and Earnings SIC Code 36 appear on page 23 of Report 154.

Monthly data 1977-1980 for Producer Price Index-All Commodities, appear on page 21 of Nuexco Report 158.

[7] Monthly data 1979-1982 for all listed indices appear on page 41 of Report 184.

NUEXCO

REPRESENTATIVES AND CONSULTANTS

AUSTRALIA

Peter Stork
Oratom Consulting
5 Gould Ave.
St. Ives
NSW 2075, Australia
Telephone: (61-2) 449-6783
Telex: AA123976 (COMTLX)

JAPAN

Kazy Yokota
Japan Tech Services
Ohkura Building (3F)
1-4-10 Shiba Daimon
Minato-ku, Tokyo, Japan
Telephone: (81-3) 431-6031, 6025
Telecopy: (81-3) 434-6674
Telex: 242-5060 (JATECH J)

SOUTH AFRICA

Chris I. Von Christierson
Southern Prospecting (Pty) Limited
P.O. Box 61409
Marshalltown 2107
Republic of South Africa
Street Address:
10th Floor
Eagle Star House
70 Fox Street
Johannesburg 2001
Telephone: (27-11) 838-1868
(27-11) 834-4211
Telecopy: (27-11) 834-3148
Telex: 4-89878 SA

TAIWAN

Edward Bee
Bee & Liang Company, Ltd.
14 FL Universal Business Center
NO. 663, Tun Hwa South Road
P.O. Box 1396
Taipei, Taiwan R.O.C.
Telephone: (886-2) 704-9630
TWX: 785-11570 (BEELIANG)

UNITED STATES

Harold C. Lindberg
83-A Hardee Lane
Whispering Pines, N.C. 28327
Telephone: (919) 949-3622

M. Jerry Reaves
Suite 905
Ten Piedmont Center
Atlanta, Georgia 30305
Telephone: (404) 262-7375

Ralph O. Smith
141 Braemar Drive
Cheshire, Connecticut 06410
Telephone: (203) 272-6246

SPECIAL CONSULTANTS

George J. Stathakis
International Investment Banking

James C. C. Stewart
U.K. Nuclear Industry

Claus C. Thiesen
Japan Nuclear Industry

W. Bryan Webster
International Business Development

J. Robert Wolcott
International Business Development

NUEXCO

EXECUTIVE SUMMARY
REPORT 211
(All data as of February 28, 1986)

Exchange Value
$17.00, unchanged

The **Exchange Value** is **$17.00** per pound U_3O_8, unchanged since last month.

UF_6 Value
$48.00, up $1.00

The **UF_6 Value** is **$48.00** per kilogram U as UF_6, up $1.00 since last month.

Transactions

Four recent natural uranium sales and one of low-enriched uranium are reported, involving approximately one million pounds equivalent U_3O_8. All of the sales involved spot or near-term delivery and three met the conditions for inclusion in the Transaction Value. One transaction involved natural UF_6.

Supply-Demand Ratio
increased to 2.5:1

Active spot and near-term **uranium supply** amounts to **2.4 million** pounds U_3O_8 equivalent, down 1.5 million pounds since last month. Active spot and near-term **uranium demand** totals **975 thousand** pounds, down 1.8 million pounds. The spot and near-term **supply-demand ratio** rose to **2.5:1.**

Transaction Value
$16.70, up $0.15

The **Transaction Value** is **$16.70** per pound U_3O_8, up $0.15 since last month. The calculation includes 16 transactions involving a total of 2.6 million pounds U_3O_8 and equivalent UF_6, and covers a period of 5 months.

Loan Rate
unchanged at 5%

The **Loan Rate** is **5 percent** per annum, unchanged.

Conversion Value
$1.80, up $0.20

The **Conversion Value** is **$1.80** per pound U as UF_6, up $0.20 since last month. Active secondary market supply for conversion services for delivery within three years totals 865 thousand pounds U as UF_6. Active demand totals 950 thousand pounds U as UF_6. No secondary market conversion transactions are reported.

SWU Value for
delivery within
one year: $80

The **SWU Value** at .3 tails and for delivery within one year is **$80** per SWU, unchanged since last month. Four secondary market SWU transactions are reported, involving 200 thousand SWUs.

* * *

Enrichment

In recent months, the US Department of Energy (DOE) has implemented various moves designed to reinforce its position with regard to the gains made by its European competitors in the market for enrichment services as well as the court ruling against its standard enrichment contract. Nuexco examines the utility response to DOE's latest incentive pricing campaign, and also comments on some of the implications of its proposed revisions to the enrichment criteria.

Analysis and
Commentary

No nuclear units were canceled in the USA in 1985, an achievement that last occurred in 1973. As of February 1986, 34 units comprised the nuclear plant construction backlog in the USA. Eighteen of those units are at least 90-percent complete, an encouraging sign for growth in installed nuclear capacity in the next several years.

Analysis and
Commentary

Nuexco's estimate of WOCA uranium reserves (reasonably assured resources recoverable at a cost of less than US$30 per pound U_3O_8) totals approximately 4,000,000,000 pounds U_3O_8, enough to supply world reactor requirements for at least the next 30 years.

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NUEXCO REPORT 211 FIGURES OF THE MONTH (February 28, 1986)	This Month (Report 211)	Last Month (Report 210)	12 Months Ago (Report 199)
Exchange Value[1]	17.00	17.00	15.00
Transaction Value[1]	16.70	16.55	15.70
UF_6 Value[2]	48.00	47.00	—
Loan Rate[3]	5%	5%	5%
Conversion Value[4]	1.80	1.60	1.00
Near-Term Uranium Supply[5]	2.4	3.9	5.3
Near-Term Uranium Demand[6]	1.0	2.8	2.3
Near-Term Supply-Demand Ratio	2.5	1.4	2.3
Recent Uranium Sales:			
Number of Transactions[7]	5	6	9
Quantity of Material[8]	1.0	8.7	2.1
Nuexco SWU Value:[9]			
at 0.3 tails assay and delivery within one year	80	80	—
USDOE SWU Prices:			
USEC	125.00[10]	125.00[10]	135.00
AFC	153.00[11]	153.00[11]	153.00[11]
Requirements	157.00[11]	157.00[11]	157.00[11]
Market Value of Enriched UF_6[12,13]:			
2.5 w/o U_{235}	462	460	481
3.0 w/o U_{235}	592	589	621
3.5 w/o U_{235}	724	720	765
4.0 w/o U_{235}	858	854	911

---

[1] US $ per pound U_3O_8 equivalent.

[2] US $ per kilogram U as UF_6.

[3] Per annum.

[4] US $ per pound U as UF_6.

[5] Active inquiries to sell, for delivery within 12 months after contract signing (millions of pounds U_3O_8).

[6] Active inquiries to purchase, for delivery within 12 months after contract signing (millions of pounds U_3O_8).

[7] Uranium sales only; does not include loans, conversion, or SWU transactions.

[8] Millions of pounds U_3O_8, equivalent.

[9] US $ per SWU.

[10] Effective 10/1/85.

[11] Effective 10/1/84.

[12] Calculated using the Nuexco Exchange Value, Conversion Value, and 0.30 percent tails assay. From 4/30/85 to 11/30/85, calculations used in the Nuexco SWU Value for DOE origin and delivery by the end of FY86. As of 12/31/85, calculations use the SWU Value for delivery within one year.

[13] US $ per KgU as UF_6, rounded to the nearest $.

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MONTHLY REPORT

ON THE NUCLEAR FUEL MARKET

NUEXCO

HEADQUARTERS

Three Park Central
1515 Arapahoe Street
Suite 1045
Denver, Colorado 80202
Telephone: (303) 893-4015
Telecopy: (303) 825-4821
Telex: 450202 (NUEXCO DVR)

Chairman of the Board of Partners
Oren L. Benton

Vice Chairman of the Board of Partners
Samuel R. Freeman

EASTERN UNITED STATES

100 Prospect Street
Century Plaza South
Stamford, Connecticut 06901
Telephone: (203) 323-1999
Telecopy: (203) 325-1483
Telex: 4750124 (NUEXCO C)

Managing Broker
Earl E. Hoellen, Jr.

WESTERN UNITED STATES

Building 3, Suite 290
3000 Sand Hill Road
Menlo Park, California 94025
Telephone: (415) 854-1510
Telecopy: (415) 854-2115
Telex: 470674 (NUEXCO UI)

Managing Broker
George White, Jr.

EUROPE

13 chemin du Levant
01210 Ferney-Voltaire
France
Telephone: (33-50) 428035
Telecopy: (33-50) 428526
Telex: 385288 (NUEXCO F)

Managing Broker
James E. Vaughan

REGIONAL MANAGING BROKERS

AFRICA
James E. Vaughan

AUSTRALIA
George White, Jr.

CANADA
Wayne D. Fowler
(303) 893-4015

FAR EAST
Christian C. Guitton
(415) 854-1510

MEXICO AND SOUTH AMERICA
Earl E. Hoellen, Jr.

(See inside back cover for list of Representatives and Consultants)

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MONTHLY REPORT ON THE NUCLEAR FUEL MARKET

April 1986 No. 212

GEORGE WHITE, JR., *EDITOR* CLARK M. BEYER, *ASSOCIATE EDITOR*

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PRICING

NATURAL URANIUM AND SECONDARY MARKET CONVERSION

(All data as of March 31, 1986)

The **Exchange Value** is **$17.25** per pound U_3O_8, up $0.25 since last month. **Active supply** of natural uranium (concentrates and UF_6) for spot or near-term delivery totals **2,525,000** pounds U_3O_8 equivalent, up 120 thousand pounds since last month. The corresponding figure for **active demand** is **950,000** pounds, down 25 thousand pounds. The spot and near-term **supply-demand ratio** increased to **2.7:1.**

The *Current Market Data* section of this Report lists three natural uranium sales and two of enriched uranium, involving approximately 500,000 pounds equivalent U_3O_8. All of the transactions involved near-term delivery and two met the criteria for inclusion in the current Transaction Value calculation. Three transactions involved natural UF_6.

The **Transaction Value** is **$16.70** per pound U_3O_8, unchanged since last month. The calculation extends over a 6-month period and includes 18 transactions involving 2.7 million pounds equivalent U_3O_8.

The **UF_6 Value** is **$48.00** per kilogram U in UF_6, unchanged since last month.

The **Conversion Value** is **$1.80** per pound U in UF_6, unchanged since last month. Active supply of secondary market conversion services for delivery within three years totals 975 thousand pounds U as UF_6. Active demand totals 950 thousand pounds U as UF_6. No secondary market conversion transactions are reported.

The **Loan Rate** is unchanged at **5 percent** per annum.

* * *

The Exchange Value rose to $17.25, reflecting some firming in the market for natural uranium concentrates. There was relatively little activity in March, but subtle changes in the market became apparent towards the end of the month. Two factors were principally responsible for the rise in the Exchange Value.

1. One large block of lower-priced U_3O_8 was withdrawn from the market.

2. Although overall active spot and near-term demand remained relatively thin, one new block of demand recently appeared.

Uranium sellers generally offered material at higher price levels than were offered last month, and though buyers failed to respond, the small rise in the Exchange Value reflects both the widening gap between sellers and buyers and the sense that higher prices will be needed to conclude new transactions. Demand levels are low for natural uranium concentrates; all of the transactions reported this month involved natural or enriched UF_6.

The UF_6 Value was unchanged, largely because there are still significant quantities of supply at the $48.00 level in the market, and several buyers are actively seeking material at that general price level. One such transaction involving a US utility was concluded during March. A number of utilities continue to solicit offers for longer-term deliveries, and several are expected to reach agreements for supply in the next few months.

* * *

The Conversion Value remained at $1.80 this month, as there was little activity in the secondary market for conversion services. No transactions are reported. Uncertainties regarding the shutdown of operations at Sequoyah Fuels' conversion facility, though still prevalent, failed to cause additional potential buyers of conversion services to enter the secondary market.

* * *

ENRICHED URANIUM AND SWUS

The **SWU Value** as of March 31, 1986, is $80 per SWU. This refers to SWU at a tails assay of 0.30 weight-percent U_{235} and for delivery within one year. Three secondary market SWU transactions are reported this month, involving approximately 100 thousand SWUs. Two of the transactions involved enriched uranium.

Most of the SWU available at present is priced near the $80 level, although both supply and demand are low. One seller, a US utility, appeared in the middle of the month and expressed an interest in liquidating a relatively large quantity of SWU in a short time. Offered at a lower price level, the inventory sold quickly, leaving only smaller blocks of SWU in the market. Without competition stemming from the presence of firm buyers, there was little downward pressure on those asking prices.

* * *

DOE recently informed its customers that as of the beginning of fiscal year 1987, the price ceiling under the Utility Services enrichment contract (USEC) will be reduced to $120 per SWU from the FY86 ceiling of about $134 per SWU. Thus, the FY87 USEC price structure consists of a base price of $119 per SWU and a ceiling price of $120 per SWU. The new ceiling price is subject to the same escalation factor as was the previous ceiling, incorporating the US GNP Implicit Price Deflator. The reduced ceiling probably will not have a significant effect on most of DOE's utility customers; they will benefit chiefly from the reduced *base* price.

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CURRENT MARKET DATA

March 31, 1986	Market Values	Active Supply[1] (thousands)	Active Demand[1] (thousands)
EXCHANGE VALUE	**$17.25**/lb. U_3O_8	2,525	950
UF_6 VALUE	**$48.00**/kgU		
CONVERSION VALUE	**$1.80**/lb. U as UF_6	975	950
SWU VALUE 0.3 tails assay; delivery within one year	**$80**/SWU		
LOAN RATE	5%/annum	0	0

	$/lb. U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
TRANSACTION VALUE	**16.70**	2.7	18	6

[1] Supply and demand tables in *Current Market Data* section of this Report detail the numbers for each category.

DEFINITIONS

1. The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.
2. The **UF_6 Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.
3. The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.
4. The **SWU Value** represents Nuexco's judgment of the price at which transactions for the sale of significant quantities of SWUs of stated origin for delivery in the specified time period could be concluded as of the date indicated.
5. The **Loan Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.
6. The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
   a. Transactions closed within the previous three-month period for which delivery is scheduled within one year of the transaction date;
   b. At least ten transactions;
   c. Transactions involving a sum total of at least 2 million pounds U_3O_8 equivalent.

   The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

DERIVATIONS AND COMMENTS

1. All Market Values are based on:
   a. Data from recently completed transactions.
   b. Data from pending transactions.
   c. Firm bids to buy or borrow, and firm offers to sell or lend.
   d. Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell or lend.
2. Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these Market Values.
3. In the determination of the Conversion Value, Nuexco does not consider transportation charges other than those customarily provided by primary suppliers of conversion services.
4. The prices of conversion services or SWUs delivered under long-term contracts with primary suppliers are not considered in the determination of either the Conversion Value or SWU Value.
5. For the SWU Value, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight-percent U_{235} and a product assay of 3.0 weight-percent U_{235}, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
6. In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

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EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
Country (currency)	This Month (Mar 31, 1986)	Last Month (Feb 28, 1986)	12 Months Ago (Mar 31, 1985)	This Month (Mar 31, 1986)	Last Month (Feb 28, 1986)	12 Months Ago (Mar 31, 1985)
Australia (dollar)	24.20	23.97	21.28	62.92	62.31	47.11
Belgium (comm. franc)	823.00	771.68	940.44	2,140	2,006	2,353
Canada (dollar)	24.09	23.98	20.53	62.53	62.35	56.50
Finland (markka)	89.33	86.03	97.66	232.24	223.66	245.26
France (franc)	123.66	116.20	143.13	321.48	302.09	351.60
FRG (mark)	40.19	37.89	46.90	104.49	98.50	114.17
Italy (lira)	26,038	25,668	29,922	67,692	66,731	71,469
Japan (yen)	3,098	3,082	3,793	8,052	8,012	9,892
Netherlands (guilder)	45.53	42.67	52.80	118.36	110.93	128.78
South Africa (rand)	35.75	33.73	28.71	92.95	87.69	54.63
Spain (peseta)	2,510	2,380	2,610	6,525	6,187	6,547
Sweden (krona)	126.65	121.69	135.01	329.27	316.37	340.23
Switzerland (franc)	33.56	32.00	38.88	87.25	83.20	94.56
UK (pound)	11.68	11.58	12.20	30.36	30.11	30.43
US (dollar)	17.25	17.00	15.00	44.35	44.20	44.20

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
Country (currency)	This Month (Mar 31, 1986)	Last Month (Feb 28, 1986)	12 Months Ago (Mar 31, 1985)	This Month (Mar 31, 1986)	Last Month (Feb 28, 1986)	12 Months Ago (Mar 31, 1985)
Australia (dollar)	23.43	23.54	21.35	60.91	61.21	53.34
Belgium (comm. franc)	796.76	758.06	943.57	2,071	1,971	2,665
Canada (dollar)	23.32	23.56	20.60	60.63	61.25	63.97
Finland (markka)	86.48	84.51	97.98	224.84	219.72	277.72
France (franc)	119.71	114.15	143.61	311.23	296.76	398.14
FRG (mark)	38.91	37.22	47.06	101.16	96.76	129.28
Italy (lira)	25,208	25,215	30,022	65,543	65,554	80,928
Japan (yen)	2,999	3,028	3,805	7,796	7,871	11,201
Netherlands (guilder)	44.08	41.92	52.97	114.59	108.98	145.82
South Africa (rand)	34.61	33.13	28.80	89.98	86.14	61.86
Spain (peseta)	2,430	2,338	2,619	6,317	6,078	7,413
Sweden (krona)	122.61	119.54	135.46	318.77	310.78	385.26
Switzerland (franc)	32.49	31.44	39.01	84.47	81.73	107.07
UK (pound)	11.31	11.38	12.24	29.39	29.58	34.46
US (dollar)	16.70	16.70	15.05	43.42	43.42	50.05

[1] Calculated using currency exchange rates published in the *Wall Street Journal* on March 31, 1986.

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CURRENT MARKET DATA

CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U as UF₆			per kg. U as UF₆		
Country (currency)	**This Month (Mar 31, 1986)**	**Last Month (Feb 28, 1986)**	**12 Months Ago (Mar 31, 1985)**	**This Month (Mar 31, 1986)**	**Last Month (Feb 28, 1986)**	**12 Months Ago (Mar 31, 1985)**
Australia (dollar)	2.53	2.54	1.42	5.57	5.59	3.13
Belgium (comm. franc)	85.88	81.71	62.70	189.33	180.13	138.22
Canada (dollar)	2.51	2.54	1.37	5.54	5.60	3.02
Finland (markka)	9.32	9.11	6.51	20.55	20.08	14.35
France (franc)	12.90	12.30	9.54	28.45	27.12	21.04
FRG (mark)	4.19	4.01	3.13	9.25	8.84	6.89
Italy (lira)	2,717	2,718	1,995	5,990	5,992	4,398
Japan (yen)	323.22	326.32	252.84	712.57	719.42	557.43
Netherlands (guilder)	4.75	4.52	3.52	10.47	9.96	7.76
South Africa (rand)	3.73	3.57	1.91	8.22	7.87	4.22
Spain (peseta)	261.89	252.00	174.00	577.38	555.55	383.61
Sweden (krona)	13.22	12.88	9.00	29.14	28.41	19.84
Switzerland (franc)	3.50	3.39	2.59	7.72	7.47	5.71
UK (pound)	1.22	1.23	0.81	2.69	2.70	1.79
US (dollar)	1.80	1.80	1.00	3.97	3.97	2.20

SWU VALUE AND UF₆ VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	**SWU VALUE delivery within one year (March 31, 1986)**	**UF₆ Value per kg.U in UF₆ This Month (March 31, 1986)**	**UF₆ Value per kg.U in UF₆ Last Month (February 28, 1986)**
Australia (dollar)	112.23	67.34	67.67
Belgium (comm. franc)	3,817	2,290	2,179
Canada (dollar)	111.72	67.03	67.72
Finland (markka)	414.29	248.58	242.91
France (franc)	573.48	355.09	328.09
FRG (mark)	186.39	111.84	106.98
Italy (lira)	120,755	72,452	72,475
Japan (yen)	14,36[illegible]	8,619	8,702
Netherlands (guilder)	211.14	126.68	120.48
South Africa (rand)	165.80	99.48	95.24
Spain (peseta)	11,640	6,984	6,720
Sweden (krona)	587.37	352.42	343.59
Switzerland (franc)	155.64	93.39	90.36
UK (pound)	54.16	32.50	32.70
US (dollar)	80.00	48.00	48.00

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on March 31, 1986.

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RECENT TRANSACTIONS[1]

Uranium Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price as Percent of Current Exchange or UF_6 Value	Seller	Buyer	Remarks
3698	1986	50-100	102	European Utility	R[5]	UF_6.
3697A	1986	50-100	indeterminate	European Utility	European Utility	Contained in enriched uranium.
3696	1987	101-300	100-101	R[5]	US Utility	UF_6.
3695	1986	less than 50	98	Canadian Producer	European Utility	UF_6.
3694A	1986	less than 50	96	Trader	European Utility	Contained in enriched uranium.

Enrichment Services
Secondary Market Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity[2] (thousands of SWUs)	Approximate Price[3] as Percent of Current SWU Value[4]	Seller	Buyer	SWU Origin	Remarks
3699	1986	50-100	94	US Utility	European Utility	DOE	
3697B	1986	less than 50	indeterminate	European Utility	European Utility	R[5]	Contained in enriched uranium.
3694B	1986	less than 50	88	Trader	European Utility	DOE	Contained in enriched uranium

[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] If tails assay is unknown or unspecified, Nuexco's calculation of SWU quantity assumes 0.20 w/o tails assay.

[3] Price is not normalized to 0.20% tails assay.

[4] Refers to SWU Value that corresponds to SWUs included in transaction. When prices and SWU values are expressed as discounts (e.g. X dollars less than DOE's USEC base price at time of delivery), the percentage refers to the ratio of the *discounts*, not the ratio of the prices.

[5] The notation *R* means that Nuexco either does not know, or that Nuexco has restricted that information to protect client confidentiality.

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CURRENT MARKET DATA

URANIUM SUPPLY
(March 31, 1986)

	Delivery Period[1] (Thousands of Pounds U_3O_8)		
Nuexco Project Number	**Spot or Near-term[2]**	**Intermediate or Long-term**	**Remarks**
Available for Sale:			
ACTIVE			
2335*	400	—	
2728	350	—	
2740	175	—	
2802	200	—	UF_6
2838*	50	—	UF_6
2919*	350	—	UF_6
2933*	250	250 per year	
3023	750	500	UF_6
2263		400 per year	1987 on
2625	—	500 per year	1987 on
2778	—	220 per year	1987-90
2781	—	100 per year	1988-95
TOTAL	2,525		
INACTIVE			
2336	250	250 per year	1986-94
2389	75	75 per year	1986-90
2703*	750	—	
2764	260	—	UF_6
2765	260	—	UF_6
2777	250	—	
2813*	15	—	
2851	125	—	
2853*	65	—	
2871*	50	—	
2297	—	200 per year	1986-89
TOTAL:	2,100		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2793.

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URANIUM DEMAND
(March 31, 1986)

	Delivery Period[1] (Thousands of Pounds U_3O_8)		
Nuexco Project Number	Spot or Near-term[2]	Intermediate or long-term	Remarks
Inquiries to Purchase: ACTIVE			
2743*	200	—	UF_6
2806*	500	—	
2930*	250	—	UF_6
2217	—	1,000 per year	1989-95
2507	—	600	1987-89
2586	—	250 per year	1988-95
2681	—	500 per year	UF_6 or U_3O_8; 1987-88
2738	—	1,000	1989 on
2760	—	750 per year	1986-90
2770	—	500 per year	1988-94
2782*	—	900	1988
2808	—	300	1987 on
2821	—	120 per year	1988-93
2850	—	300 per year	1990-95
2870	—	100	1989
TOTAL:	950		
INACTIVE			
2548	290	—	
2733	500	500 per year	1987-95
2784	100	—	
2786*	65	—	
2798	70	—	
TOTAL:	1,025		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2739, 2811, 2820, 2888.

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CURRENT MARKET DATA

LOAN SUPPLY AND DEMAND
(March 31, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Within 1 Year	Beyond 1 Year	Remarks
Available for Loan:			
INACTIVE			
1938	2,000	—	UF_6
2036	500	—	
2667	800	—	
2805	2,000	—	
TOTAL:	5,300		

*New or revised since last month.
[1] Measured from the date of this Report.
Projects removed since last month: None.

No inquiries to borrow are reported this month.

CONVERSION SUPPLY AND DEMAND
(March 31, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U as UF_6) Within 3 Years	Beyond 3 Years	Remarks
Available for Sale:			
ACTIVE			
2717*	175	—	
2849	300	900	1986-90
2874*	500	—	
TOTAL:	975		
Inquiries to Purchase:			
ACTIVE			
2833	400	—	
2865	450	—	
TOTAL:	950		
INACTIVE			
2882	—	1,000	1987
TOTAL:	0		

*New or revised since last month.
[1] Measured from the date of this Report.
Projects removed since last month: 2864.

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SWU SUPPLY AND DEMAND
(March 31, 1986)

	Delivery Period[1] (Thousands of SWUs)		
Nuexco Project Number	Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
2571	—	55	1987
2873	40	—	
2914*	50	—	
TOTAL:	90		
INACTIVE			
2410A	340	—	
TOTAL:	340		
Inquiries to Purchase:			
ACTIVE			
2844*	20	—	
3024	10	—	
TOTAL:	30		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes SWUs deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2811, 2889.

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THE MOUNT TAYLOR PROJECT

Introduction

Following a year-long assessment program, Chevron Resources Company announced on March 14 that it plans to proceed with commercial production at its Mount Taylor uranium mine, located in the Grants Mineral Belt in New Mexico. The test program was begun in March 1985 to determine the economic viability of the project with a view to establishing long-term uranium production for world markets. The mine initially was developed by Gulf Minerals Resources Company over an eight-year period; Gulf produced almost two million pounds U_3O_8 before placing the mine on standby status in 1982 because of diminishing market opportunities. Chevron Corporation assumed ownership of the project when it acquired Gulf in 1984. Chevron plans to mine 600 tons of ore per day during 1986, and expects full production to yield about 1.5 million pounds U_3O_8 per year.

Chevron's assessment program included revised mining, engineering and processing procedures for the project, focusing on high-grade ore zones and mining lower tonnages than in the Gulf operation. The proposed target tonnage in the Gulf project was to be 4,000 tons per day. The primary obstacles for Chevron consisted of rehabilitating the existing workings of the mine and developing innovative mining methods to compensate for the mine environment, chiefly high temperatures throughout the mine caused by large volumes of hot formation water. Chevron maintained a mining rate of at least 500 tons per day of ore throughout the last quarter of the test period, and the average ore grade produced was in excess of 0.50 percent U_3O_8. In addition, development drifting into previously untested ore zones indicated the availability of sufficient high-grade tonnage to support long-term mining requirements.

The Mount Taylor uranium deposits represent a geologic reserve of over 120 million pounds U_3O_8, perhaps the largest block of uranium reserves presently available in the USA. The deposits extend along a northwest-southeast strike length of about six miles and lie at an average depth of about 3,350 feet below the surface (3,100 feet at the present mine location), and are considered to be the eastward extension of the Ambrosia Lake mineral trend, first discovered in the early-1950s and heavily mined since then. Figure 1 shows the location of the Mount Taylor mine in relation to the general ore trend from the Churchrock district to the west and the Marquez/L-Bar district to the east.

Exploration History

Uranium exploration and mine development in the Ambrosia Lake area of New Mexico progressed rapidly during the initial exploration rush of the early to mid-1950s. Exploration competition gained momentum with each discovery and by the early 1960s, discoveries at depths of 2,000 to 3,000 feet had been recorded along the main trend of mineralization to the northwest and southeast of Ambrosia Lake. Anaconda reportedly made one such discovery at a depth of about 3,100 feet in the west San Mateo area, thereby extending the trend potential another six to eight miles to the southeast. However, the revised uranium procurement program initiated April 1, 1962 by the US Atomic Energy Commission (AEC) lowered the buying price of uranium from $12.00 per pound U_3O_8 to $8.00 per pound, discouraging uranium exploration and development efforts.

Subsequently, many small exploration groups were driven out of the business; the larger, well-established companies survived and continued their exploration efforts at least on a limited basis. In general, the industry remained reluctant to undertake new exploration commitments until 1966, when the US government imposed an embargo on the enrichment of non-US uranium destined for use in domestic power plants. The embargo assured additional domestic uranium requirements for US utilities, and created the incentive for deeper and more costly exploration programs.

One such program was initiated by Keradamex Inc., a joint venture of Noranda Mines Ltd. and Kerr Addison Ltd. Keradamex acquired leases on the Fernandez Ranch properties in 1968 and made several important discoveries in the vicinity of the ranch headquarters and east toward the village of San Mateo. Amerada Hess Corporation and Keradamex formed the Fernandez Joint Venture (FJV) later that year. Through 1970, the joint exploration effort resulted in the discovery and partial delineation of several large ore deposits along the trend which now makes up a large portion of the Mount Taylor uranium reserves.

Bokum Corporation staked mining claims to the southeast of the FJV discoveries and began drilling in early 1970. The Bokum drilling encountered high-grade uranium at a depth of about 4,000 feet, the deepest discovery at the time. Bokum and the FJV resolved a title dispute on the claims by entering into a equal-share joint venture. Eventually, the Bokum discovery was tied to the FJV discoveries through additional drilling, and the identified ore trend extended six miles across the Mount Taylor properties.

Gulf Mineral Resources Company began uranium exploration in the Grants Mineral Belt about 1968. The company recorded discoveries in the Mariano Lake and West Largo areas in 1969. Gulf developed an underground mine on the Mariano Lake deposit and continued mining operations, finally closing the mine in mid-1982. The West Largo deposit was later traded to Santa Fe Mining Company for a lease at Mount Taylor. In early

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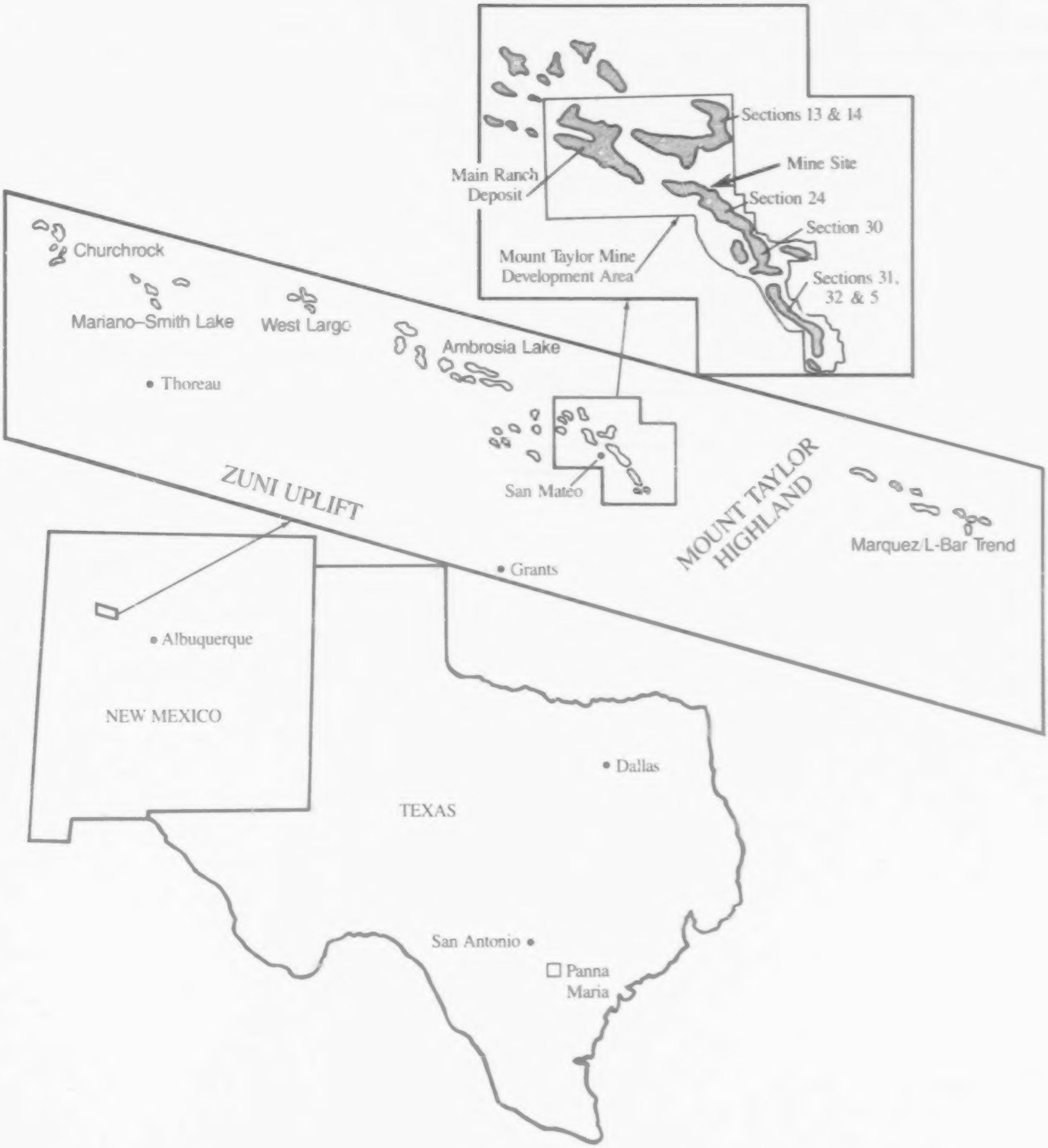
Sections 13 & 14
Mine Site
Main Ranch Deposit
Section 24
Section 30
Mount Taylor Mine Development Area
Sections 31, 32 & 5
Churchrock
Mariano–Smith Lake
West Largo
Ambrosia Lake
Thoreau
San Mateo
ZUNI UPLIFT
MOUNT TAYLOR HIGHLAND
Marquez/L-Bar Trend
Grants
Albuquerque
NEW MEXICO
TEXAS
Dallas
San Antonio
Panna Maria

Figure 1. Location map of Mount Taylor mine project. Middle inset shows location of the project within the Grants Uranium Belt, and upper inset illustrates the Mount Taylor development area.

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1971 Gulf took its first position in the Mount Taylor project through the acquisition of the Amerada Hess interest in the FJV. Gulf's title position was 49 percent interest in the FJV and 24.5 percent interest in the Bokum claim block. However, by June 1971 Gulf had acquired full interest in the claims by acquiring Bokum's 50 percent interest and Keradamex's 24.5 percent interest. Gulf immediately accelerated exploration and development drilling on the properties, completing over 200 holes for a total of almost 590,000 feet drilled by the end of 1975. (To date, 689 holes have been drilled by all participants since 1968, totaling 2,164,360 feet.) Gulf's accelerated program included the drilling of a mine shaft pilot hole located in Section 24 in late 1971. The hole was core drilled to a depth of about 3,300 feet to obtain the geologic information needed to conduct preliminary engineering studies.

In order to gain full interest in the Mount Taylor ore deposits, Gulf made some land trades. In 1974 Gulf made a trade with Conoco, forfeiting one block of claims situated north of the main ore trend in exchange for three claims strategically located to assure uninterrupted mining access to 2.5 miles of ore continuing to the southeast. Additional trades in 1977 and 1979 completed the land transactions, leaving Gulf with full ownership except for royalties due on certain lands, including claims and Santa Fe Railroad leases.

By the end of 1977, the Mount Taylor ore trend was well delineated, extending west to east from the Main Ranch deposit at a depth of 3,000 feet to the claim block in Section 5 at a depth of 4,000 feet. The varying drill depth required to reach the ore is primarily due to topographic changes along the foothills of Mount Taylor; the mineralized horizon generally follows the gradual dip of 5 degrees or less to the southeast along trend. The inset in Figure 1 shows the location and configuration of the uranium trend as it is known to occur within the Mount Taylor mine development area.

Ore Deposits and Geology

Commercial ore deposits throughout the Grants Mineral Belt generally have formed as tabular bodies of irregular lateral extent, thickness and uranium content. The important deposits in the Morrison Formation vary widely in size from small pods with little or no commercial value to large ore masses several thousand feet long, several hundred feet wide, and tens of feet thick. The deposits usually form in clusters elongated in the direction of paleostream sedimentation, primarily in two of six designated sandstone units in the Westwater Canyon Member of the Morrison Formation. Ore occurs in two types of deposits in the Grants Mineral Belt: trend or primary ore, and redistributed ore. Deposits may consist of either or both types.

The Mount Taylor ore trend is a continuation of the Ambrosia Lake trend. Characteristics of sedimentation and mineral occurrence essentially are the same; however, one significant difference is the depth relationship. The deeper ores at Mount Taylor are totally unoxidized and preserved in trend-type deposits. Redistributed-type ore has not yet been identified at Mount Taylor.

The mineral suite is essentially the same as in neighboring regions, consisting of extremely fine-grained minerals identifiable only by X-ray analysis. Coffenite (uranium silicate) is the main uranium mineral present, but uraninite (uranium oxide) is a common companion mineral. Pyrite is abundant in portions of both areas. Molybdenum is scarce in Ambrosia Lake, but somewhat common at Mount Taylor, occurring primarily along the downdip or leading edge of an ore zone and containing characteristics common to geochemical fronts. Carbonaceous material is one of the most common gangue minerals present in both districts. It is usually closely associated with uranium mineralization, but at Mount Taylor it is extremely fine-grained and is less evident throughout certain ore horizons. The accumulation of mineralization is associated with changes in sedimentation patterns such as abrupt sand-silt-mudstone facies changes, cross-bedding and local disconformities. Rock permeability at Mount Taylor undoubtedly controlled solution flow and associated ore deposition along the geochemical fronts exhibiting typical roll front characteristics.

Geologists consider the source of uranium and associated minerals throughout the Grants Mineral Belt to be uranium-bearing volcanic materials, primarily thick tuffaceous accumulations. Uranium taken into solution by migrating groundwater was eventually precipitated in favorable host sediments at the geochemical interface between an oxidizing and reducing environment. The carbonaceous material served as the reductant in that environment.

The following economic relationship of mineralization to the six sand units making up the Westwater Canyon Member exists at Mount Taylor: the "C" sand contains the largest and highest-grade ore deposits, and the "B" sand is second in importance, containing a large reserve at the south end of the property. Ore accumulations in the remaining four sands are small and low-grade by comparison, and are considered to have only limited economic potential. Figure 2 is a stratigraphic section of the Westwater Canyon Member showing the relationship of uranium potential to each sand unit.

There are three major deposits in the "C" sand and one in the "B" sand within the boundaries of the Mount Taylor mine development area. Each deposit is sinuous in all dimensions, and mineralization ranges from thin stringers to concentrations which are ten or more feet thick, tens of feet wide, and as much as several thousand feet long. Ore thickness may increase to as

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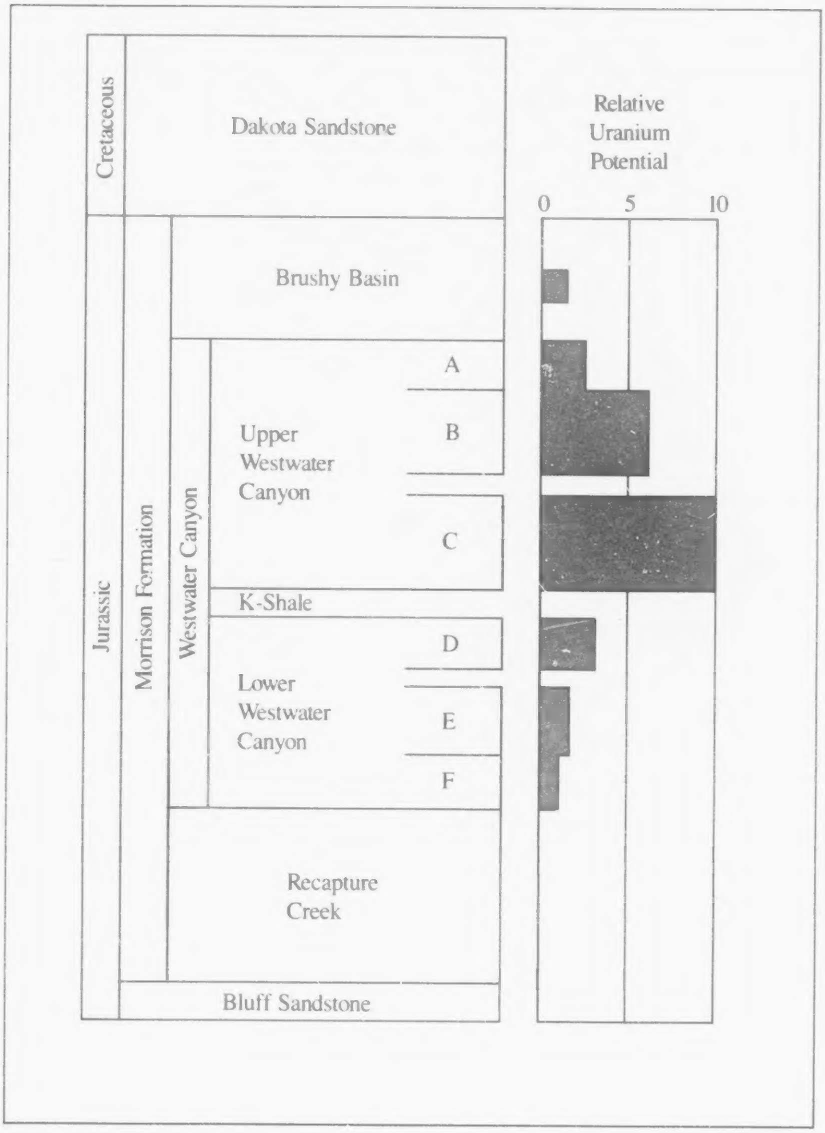

Figure 2. Stratigraphic section of the Morrison Formation, highlighting the six sandstone splits in Westwater Canyon. Bar on right shows the relative uranium potential of each formation member. (Adapted from SME paper by Mount Taylor Mine staff, October 1985.)

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much as 35 feet where two or more ore zones converge. That pattern is repeated many times throughout the overall ore trend, creating extensive areas of almost continuous ore (Figure 1).

Chevron estimates ore reserves along the trend to be approximately 121 million pounds U_3O_8 at an average grade of 0.25 percent U_3O_8, considering a cutoff thickness of six feet at a grade of 0.10 percent. Included in this reserve estimate is the presence of about 7.5 million pounds U_3O_8 at grades of 0.50 percent U_3O_8 or higher in the immediate vicinity of the present mine area.

Project Development

Gulf's final engineering studies and preparations for mine development at Mount Taylor began in late 1974. Two vertical access shafts were included in the mine development plan. The shafts, situated 400 feet apart, are 14 feet and 24 feet in diameter. Each shaft is concrete-lined from the surface to the bottom depth of 3,300 feet. Construction of the 14-foot shaft was started in June 1975 and completed in August 1979; construction of the 24-foot shaft was started in January 1976 and completed in December 1979. The total cost of both shafts was approximately $200 million. Figure 3 shows the 180.5-foot headframe over the 24-foot shaft and the hoist building.

The shaft sinking process proved to be a challenge to Gulf and the prime contractor, as they encountered a number of major groundwater aquifers from a depth of about 500 feet to the bottom of each shaft. A dewatering program was initiated around the shaft sites by drilling 22 holes to a depth of 3,200 feet. Ten holes penetrated the "K" shale separating the upper and lower Westwater Canyon Member; the remaining 12 holes bottomed in the upper Westwater Canyon sandstone. In addition, extensive grouting was required to overcome some of the water problems and to stabilize the ground.

The first grouting job was designed to reduce the water flow and stabilize the Point Lookout Sandstone at a depth of about 770 feet to 885 feet. The Point Lookout Sandstone is unconsolidated and fine-grained, resulting in a continuous flow of sand into the

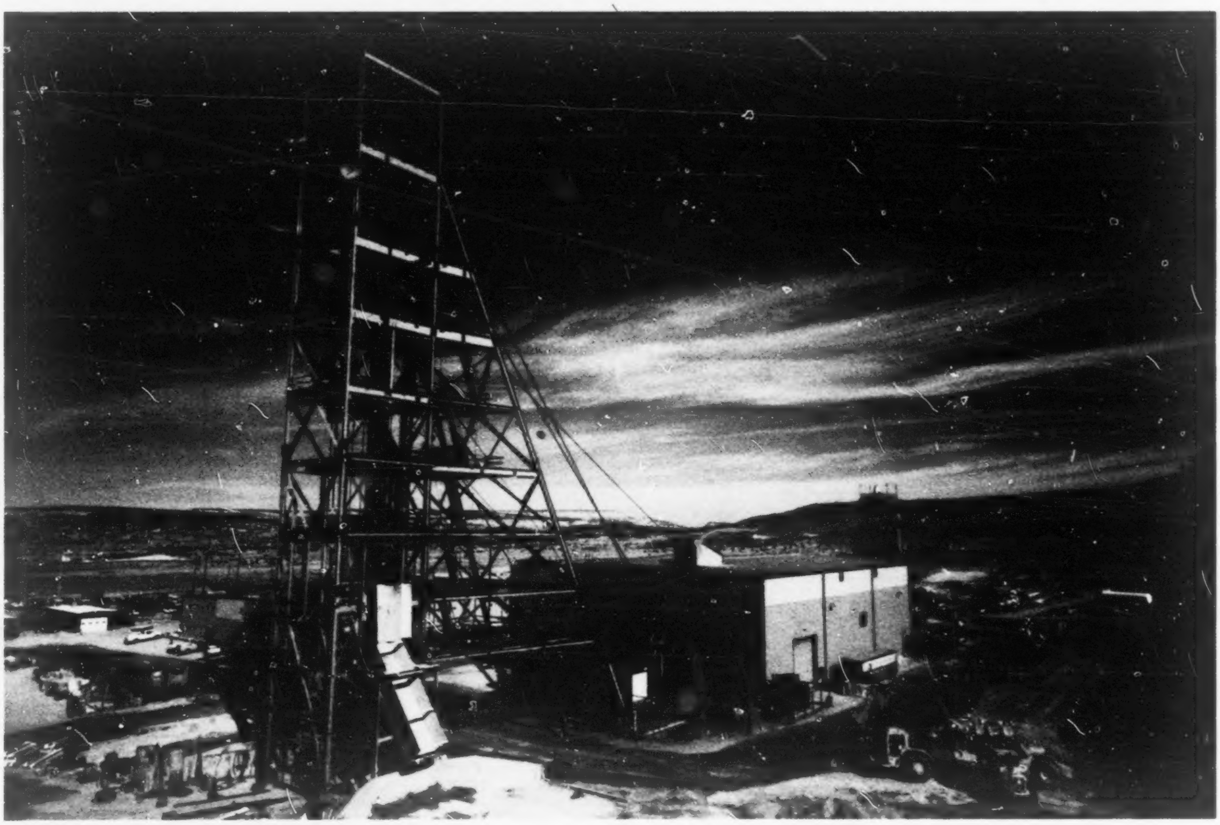

Figure 3. View of Mt. Taylor mine site looking northwest, showing the 180.5-foot headframe over the 24-foot shaft and the hoist building. The top of the headframe over the 14-foot shaft is visible over the far end of the building.

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shaft. To overcome this problem, a station was cut at the 700-foot level and a number of holes were drilled in fan patterns around the shaft and through the Point Lookout formation. Each hole was grouted from bottom to top using a chemical grout (Geoseal) under pressure. The project was largely unsuccessful; water flow was reduced minimally, and the extremely loose sand was only partially stabilized.

The same problem existed for the 24-foot shaft, but Gulf applied a different technique. First, a number of holes drilled in patterns around the shaft were allowed to flow to reduce the water pressure in the Point Lookout. Next, the shaft was sunk to the most unstable section of the Point Lookout, and 40 feet of liner plates (concave interlocking steel plates) were installed, followed by grouting behind the plates. This resulted in a sharp reduction of water flow into the shaft, and improved ground stabilization; shaft sinking continued through the Point Lookout. The same procedure was utilized to overcome the problem in the 14-foot shaft.

Although water and unstable ground problems persisted, shaft sinking advanced at a steady rate. Anticipating excessive problems in the Dakota Sandstone (at a depth of about 2,860 feet to 2,920 feet), Gulf completed pattern drilling from the pump station at the 2,600-foot level. The Dakota Sandstone was depressurized and grouted. Ground stabilization was sufficient to allow both shafts to advance through the Dakota Sandstone without serious incident or long delays. Final grouting stabilized the upper Westwater Canyon formation. Dewatering and grouting holes were drilled to a depth of 700 feet from the 2,600 level to accomplish this task. Shaft sinking continued to the final depths of 3,300 feet without serious problems.

Excessive heat plagued mine development almost from the beginning. The temperature of the groundwater increased substantially as the two shafts advanced. Water temperature in the Point Lookout was about 80 degrees Fahrenheit. It rose to 128 degrees from a depth of 2,600 feet to the bottom depth of 3,300 feet. The water temperature remains at 128 degrees Fahrenheit throughout the entire mine area. Reducing the air temperature of the mine to create favorable working conditions is one of the primary operating functions.

The master mine plan included three main levels: the ore level at 3,100 feet, the haulage level at 3,200 feet, and the sump level at 3,300 feet. The shafts were connected at each level as sinking advanced, primarily to improve ventilation and water removal in order to reduce the temperature. After the shaft connections were made, an ore development plan was initiated on the 3,100 level; ore collection, haulage and loading facilities were installed on the 3,200 level, and the 3,300 level became the mine sump for handling all drainage water. It was mid-1980 before all construction work was completed on each level.

The 14-foot shaft was used for movement of employees, materials and supplies. It also served as the fresh air intake for all mine ventilation. The 24-foot shaft was used exclusively for ore and waste hoisting and exhaust ventilation. Gulf had completed development work on the two lower levels and had mined about 250,000 tons of ore by the time the operation was placed on standby status in 1982. The mine was maintained on standby until Chevron began its assessment program in March 1985. Throughout the test program, Chevron employed 80 miners working three shifts in mining and new development, 40 persons in maintenance, and 40 staff members.

Surface facilities cover about 150 acres and include:

1. The hoist building which houses hoisting machinery for each shaft;
2. The mine office, change room, warehouse building, and maintenance shop;
3. Mine water discharge settling and treatment ponds;
4. Ore sampling and weighing building, ore stockpile area, and the waste rock storage area;
5. Support facilities, including the substation and emergency generators, compressors, the chill water plant, explosive magazines, fuel storage tanks, and mine supply yard.

Special Mining Considerations

Chevron's use of existing facilities closely follows the original project plan. The primary function of the 14-foot shaft is to move employees, materials, and supplies in and out of the mine, and it serves as the fresh air intake for all mine ventilation. The hoist is a single-drum unit, powered by a 1,300-horsepower (h.p.) electric motor. The functions of the 24-foot shaft are hoisting ore and serving as ventilation exhaust. It is also equipped with a large cage for movement of heavy mining equipment, such as the 10-ton locomotives used on the 3,200 level. Ore is hoisted in counter-balanced skips, each having a 12-ton capacity. The hoist is a double drum unit powered by two 1,250-h.p. motors.

The temperature of all working areas is reduced by removing the hot formation water as quickly as possible. A network of drain-ditches and piping allows water to drain by gravity or pipe transfer to settling sumps on the 3,300 level. (The sump and pumping system are designed to handle about 9,000 gallons of water per minute.) The water is then pumped to the 3,200 level with 200-h.p. horizontal pumps, where it is picked up by a bank of 500-h.p. pumps for lift to the surface. The water reaches the surface in two stages, assisted by additional pumps on the 2,600 level and the 1,600 level. At present, the pump rate to the surface averages 4,000 gallons per minute.

On the surface, the water is pumped to six holding ponds to allow settling of contained solid matter. The addition of barium chloride adjusts the pH, and an ion exchange plant is available for

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the removal of radium 226, but to date it has not operated. The water is allowed to cool to about 85 degrees F. before it is pumped via a 24-inch pipeline a distance of 4.5 miles for discharge into a dry stream bed.

Maintaining proper mine ventilation is an important prerequisite to successful operations at Mount Taylor. The ventilation system now in use keeps mine temperature at a reasonable level and allows for a favorable working environment at each work station. A large volume of fresh air is required at all times to reduce the temperature and eliminate radon gas and diesel fumes emitted from mining equipment. Approximately 400,000 cubic feet per minute of fresh air is forced down the 14-foot shaft to the 3,200 level. The largest volume of fresh air entering the 3,200 level is forced along the network of haulage ways and up access raises into the working stopes on the 3,100 level. Auxiliary fans move the air directly to each mining face. Air is discharged from the stopes via a return network directly into the main exhaust system.

Mechanically cooled air is made available for exceptionally hot faces. This is accomplished by passing chilled water through portable heat exchange units positioned in the fresh air supply line. The unit, called a "chiller," is located near the working stope. Using a chiller can reduce the temperature about 15 degrees. Water for the chiller is cooled to about 45 degrees on the surface and piped underground; it is also used as drill water.

Stope Development

The mining process at Mount Taylor involves three separate but interrelated activities: track haulage and hoisting activities on the 3,200 level; rotary longhole drilling on both the 3,100 and 3,200 levels; and stope development and mining on the 3,100 level. The track haulage drifts, which measure 10 feet by 10 feet, accommodate mine development on the 3,100 level, passing directly under strategic locations where raise connections allow the passage of ore to the haulage level. The haulage drifts serve a number of other mining functions, such as passage of utilities (power cables, drill water and compressed air pipelines), the distribution of fresh air by special raises (separate from ore passes), and the transport of all mined ore to the hoisting shaft.

Tramming equipment consists of 10-ton diesel locomotives, pulling a string of 7-ton capacity ore cars which are loaded at the ore chutes originating on the 3,100 level (see Figure 4). A loaded train is trammed to the hoisting facilities where each car is probed to determine the grade of ore before it is dumped either into the high-grade or low-grade section of the loading trench. (High-grade ore is 0.350 percent or higher, and is dumped in the front section; low-grade ore is 0.150 percent to 0.349 percent, and is dumped in the back section; waste is dumped into the opposite side of the trench.) Ore is loaded according to grade into 12-ton skips and hauled to the surface.

Longhole drilling has been utilized to delineate uranium mineralization and to drain formation water from areas designated for development. Originally, Gulf drilled about 500 longholes from all three levels, principally to drain and stabilize the ground throughout the mine. Chevron has concentrated longhole drilling from the 3,200 level. The holes are drilled in fan patterns, from an almost vertical position to about 15 degrees above horizontal. Several fans are drilled from the same station, to a maximum depth of 200 feet. Each hole is probed for radiometric determination of ore intervals and uranium content. Each hole is also surveyed with in-the-hole instruments for accurate orientation and plotting of information about ore. The holes are cased with two-inch plastic pipe. Collars of holes are piped into a manifold for the collection of water to minimize heat from the hot water (see Figure 5). Chevron drilled about 90,000 feet of longhole during the test period.

A stope plan of an ore block is determined on the basis of longhole drilling results and previous mining. Once the geometry of the block is established, miners drift through the block to divide it into sections, or pillars measuring approximately 70 feet

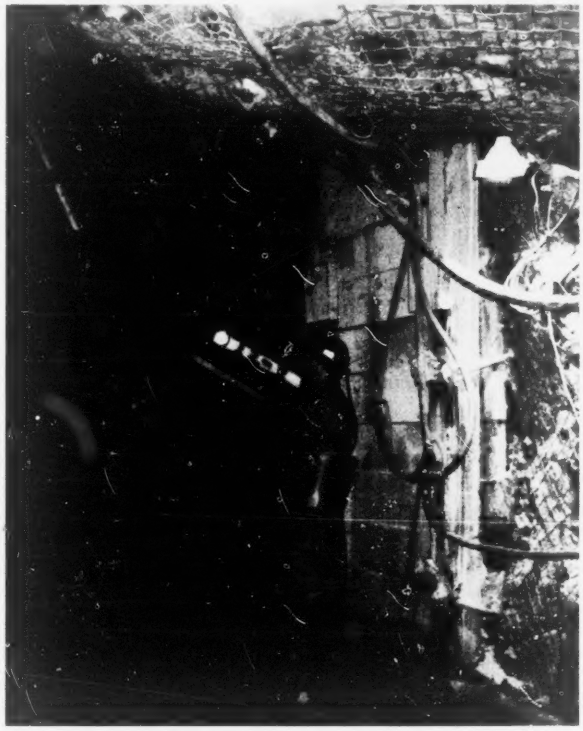

Figure 4. An ore loading chute on the haulage level. When train car is in position, hydraulic ram (upper left) opens and closes chute gate, loading the car.

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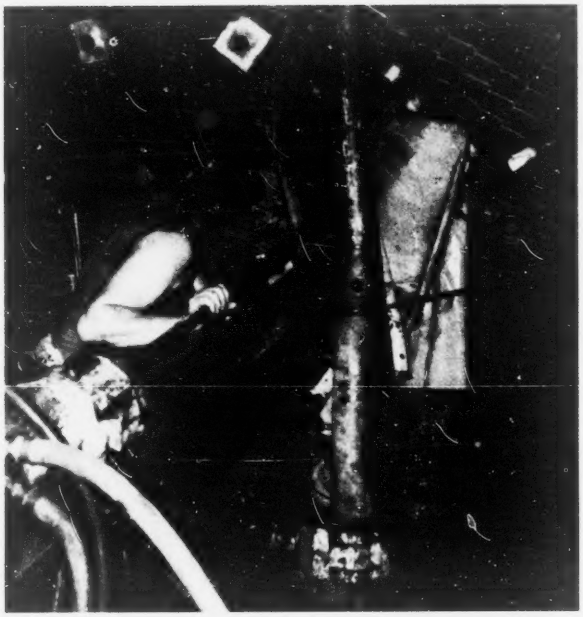

Figure 5. Longhole drilling operation using a Watson 750 Rotary Longhole Machine. Two completed holes are shown on upper right; squares at upper left are roofbolt plates. Left side of face remains to be drilled.

by 100 feet. Development drifts follow the bottom elevation of ore to minimize waste removal. The drifts are seven feet high and ten feet wide to accommodate the use of two-yard, diesel-powered load-haul-dump units (LHD) for travel over the undulating and often muddy tunnels. Mining with LHDs is the most efficient method because of the volume of material that can be moved with minimum equipment and manpower.

Pillar extraction is the final mining phase of any one ore block. Each pillar is gradually subdivided into smaller pillars in a pattern that permits efficient ore removal. During final retreat, the use of temporary ground support (timber stulls) is often required to recover the last ore. The mined-out area is then allowed to cave to the last line of pillars, which remain to protect the main access drifts.

Grade control is an important phase of the mining process. An estimate of the U_3O_8 content in the ore is maintained at strategic locations during the mining process. The estimates begin with the mapping of ribs and face, followed by drilling and probing a six-foot hole in the floor and back prior to each blast. Next, the broken ore is probed at the face. It is probed a second time in the train car prior to dumping in the hoisting trench. When it is hoisted to the surface, it is dumped into a 25-ton truck; each truckload is scanned and sampled (Figure 6). Finally, the loaded truck is dumped at one of six stockpiles according to grade determination. Ore stockpiles are separated according to the estimated U_3O_8 content. The various stockpiles facilitate better blending control to achieve maximum uranium recovery:

a. High-grade = 0.50 percent and higher;
b. Ore-grade = 0.35 percent to 0.49 percent;
c. Sub-ore = 0.15 percent to 0.34 percent;
d. Mineralized = 0.10 percent to 0.14 percent;
e. Low-grade = 0.03 percent to 0.09 percent;
f. Waste rock = less than 0.03 percent.

Ore Processing

Chevron has not announced where or how the ore from Mount Taylor will be processed. The company determined that the ore is amenable to recovery by conventional acid-leach and solvent extraction. Thus, Chevron has several options available, including processing ore at one of the local mills presently on standby status, building a new facility, or transporting the ore 960 miles to Chevron's acid mill at the Panna Maria site near Hobson, Texas (Figure 1). The first 60,000 tons mined by Chevron will be sent to Panna Maria for full metallurgical testing. The final ore processing strategy will be based on test results.

Acknowledgement

This article was made possible through the cooperation of Chevron Resources Company. Additional information is supported by articles in Memoir 15, Geology and Technology of the Grants Uranium Region, 1963. Specifically, the article *Mineralogy*, by H. C. Granger, pages 21-37, was useful in describing the uranium mineralogy of the region.

APPENDIX

Regional Geology

Uranium mineralization is known to occur in several different formations of Mesozoic age. The Westwater Canyon Member (middle member) of the Morrison Formation of Late Jurassic age is known to contain about 90 percent of the uranium in the Grants Mineral Belt. The Brushy Basin Member (upper member) contains about 8 percent in a thick sandstone lens near its upper contact with the Dakota Sandstone.* The older Todilto Limestone, which is also of Late Jurassic age, contains the remaining 2 to 3 percent.

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*This references total uranium discovered (and mined) in the Grants Uranium Belt; significant amounts of uranium discovered in the Todilto Limestone and Jackpile Sandstone have been mined out.

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The Morrison Formation consists of three members containing fluvial conglomerate, sandstone, shale and mudstone units which cover a large portion of the Four-Corners region of the San Juan Basin. In the Grants Mineral Belt, the formation tends to grade from conglomeritic sandstones in the south and west to finer materials in the north and northeast. Thickness of the three members varies from about 300 feet to a maximum of 600 feet, but district average is closer to 450 feet. The depositional sequence of the Morrison is described in ascending order (Figure 2).

The Recapture Creek Member is in conformable contact with the underlying Bluff Sandstone. It averages about 100 feet in thickness and consists of green to purple variegated shale and mudstone with intercalated fine-grained sandstone and impure limestone units. Uranium mineralization of minor economic importance is known to occur as small pods and stringers in upper sandstone layers; the probable uranium source was downward migration from uranium in the overlying Westwater Canyon sands.

The Westwater Canyon Member overlies the Recapture in conformable contact. It consists of tan to dark gray, medium to coarse-grained arkosic sandstone with interbedded mudstone layers and lenses; thickness varies from about 70 feet to 200 feet. The depositional pattern indicates the build-up of meandering stream systems flowing to the northeast, east, and southeast throughout much of the Chaco Slope area. The channel system in the Ambrosia Lake district continues into the Mount Taylor district.

The Westwater Canyon Member is subdivided into two main sandstone units at the Mount Taylor mine. The sequence consists of the upper Westwater Canyon, subdivided into the A, B, and C sands, and the lower Westwater Canyon, subdivided into the D, E, and F sands. The six sands, which are separated by discontinuous shale and mudstone layers, average 30 feet in thickness, but commonly coalesce to a thickness of 60 feet. A continuous shale bed locally referred to as the "K" shale separates the C and D sands throughout the mine area. Shale thickness may vary from 1 to 40 feet. The "C" sandstone contains most of the uranium known to occur at Mount Taylor. The deposits are characteristically much larger and higher grade than in the other sands.

The Brushy Basin Member is 50 feet to 150 feet thick and

Figure 6. An ore truck parked under the scanning device. The worker is sampling the load for a rapid lab analysis. The load is dumped in the appropriate stockpile after the grade is determined.

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conformably overlies the Westwater Canyon Member. The contact is gradational and depositional overlapping is common. It generally consists of variegated green and red clay, mudstone and interbedded sandstones which compare lithologically with the upper Westwater Canyon sands. The basal sand unit is often mineralized and in some areas is identified as the Poison Canyon Sandstone, which was mined in the southeast part of the Ambrosia Lake district. Further to the east in the Laguna district, the upper sand unit in the Brushy Basin Member has been identified as the Jackpile Sandstone, which was the source of a large deposit mined by open-pit methods. The Brushy Basin Member is overlain by the Dakota Sandstone of Cretaceous age.

Local Geologic Structure

The uranium mineralization in the Grants Mineral Belt lies entirely within the southernmost portion of the San Juan Basin, a topographic depression included as part of the Colorado Plateau province. The local structural features are primarily related to the Zuni Uplift which forms the southern limit of the basin. Generally, the sediments dip 1 to 5 degrees northward off the Zuni highland, forming the Chaco Slope.

Major faulting is directly associated with the uplift, transecting the uranium belt in at least ten locations across the 100-mile length. The faulting strikes to the north and northeast, and in some cases extends well into the basin interior. The down-dropped block is usually on the east side in the Ambrosia Lake and Mount Taylor districts, a likely influence of structural sagging into the Rio Grande Trough at the east end of the belt. Maximum fault displacement, as indicated by drilling, is about 600 feet. Numerous minor faults occur in close association with the major structures. A pattern of north-south folds, synclinal and anticlinal structures are common to the district. All structural features, including the Zuni Uplift, are Late Cretaceous to Early Tertiary in age; thus, structural activity is post ore in occurrence.

Structural changes are more pronounced in the Mount Taylor project area. The sediments dip about 5 degrees almost due east at the west end of the Main Ranch deposit, perhaps showing influence of the San Mateo anticline located 2 or 3 miles to the northwest. At the mine location, the sediments again dip 5 degrees to the north, increasing to approximately 20 degrees to the north at the southeast end of the property. Such an abrupt change probably reflects structural activity in close proximity to Mount Taylor volcanism during Pleiocene time.

Two major faults affect the Mount Taylor deposits. The San Rafael fault extends from the Zuni uplift, passes near the town of Grants, and continues northeast to displace the west end of the Main Ranch ore deposit. Displacement of the ore zone is 500 to 600 feet down to the east. The Lagunita fault displaces the ore deposit at the southeast end of the project area. Displacement is about 80 feet down to the east. A number of smaller faults occur in between. Displacement varies from a few feet to as much as 30 feet, none of which is expected to pose serious mining problems.

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RECENT DEVELOPMENTS

AUSTRALIA

The validity of an amendment to the Atomic Energy Act to approve the operation of Energy Resources of Australia's (ERA) Ranger mine has been challenged by the Northern Land Council (NLC). The NLC, an Aboriginal body, initiated the complex legal action against the Australian Government and ERA, alleging that it was forced into signing the agreement by which the Ranger mine was approved. It is seeking to have the agreement set aside. In a hearing scheduled for April 9, the Australian High Court will address the constitutional challenge of the amendment's validity.

The amendment, enacted in 1980, provided that ERA could carry on operations at Ranger as if done on behalf of and authorized by the Australian government. If the High Court finds that the amendment is valid, it then must determine whether the amendment specifically authorizes ERA to conduct mining operations even if no enforceable agreement exists with the NLC. An affirmative Court ruling on both questions would end the litigation. If the Court rules in favor of the NLC on either of these points, the legal action could continue for an extended time.

* * *

ERA announced the financial results of its operations in the second half of 1985, ending December 31, 1985. Its profits declined 15 percent in the six month period, from US$20.4 million in the last six months of 1984 to US$17.9 million in the second half of 1985. In the past four years, a significant part of ERA's Ranger profits stemmed from lucrative contracts with European and Japanese utilities. Recently, however, uranium market realities have begun to affect ERA.

During Ranger's start-up phase, utilities paid up to US$38 per pound U_3O_8. Under the agreed pricing formula, the price for the first year was fixed. For the second and third years it was subject to escalation according to Australian government labor and materials price indices. Only in the fourth year was the contract price set by reference to the international market price, subject to the Australian floor price. Although at present export prices may not be lower than the government floor price, any change in or reinterpretation of the floor price policy could put further pressure on ERA's future revenue and profitability.

CANADA

Eldorado Resources Limited has announced increased uranium reserve estimates at two projects at Eagle Point, 12 kilometers north of its Rabbit Lake mill in Saskatchewan (Figure 7). As a result of drilling during 1985, the reserve estimate at the Eagle North deposit has been increased to 20,000 metric tons uranium (MTU) (52 million pounds U_3O_8) at an average grade of 2.6 percent U_3O_8. The geologic reserve estimate was based on a cutoff grade of 0.50 percent U_3O_8. The Eagle North project is a joint venture owned by Eldorado Resources, Noranda Exploration, and Saskatchewan Mining Development Corporation (SMDC); each company owns one-third of the project.

At the Eagle South deposit, wholly owned by Eldorado Resources and immediately adjacent to Eagle North, estimated geologic reserves were increased from 13,000 MTU to more than 30,000 MTU (78 million pounds U_3O_8).

The Eagle Point deposits were discovered in 1980 by Gulf Minerals, and Eldorado Resources acquired the property in 1982. According to Eldorado, the ore at Eagle Point features high-grade and simple mineralogy in stable host rock, indicating that conventional mining methods will probably be feasible. Further exploration and definition drilling is in progress at both deposits, utilizing a total of seven drilling rigs. Eldorado has indicated that the development of the Eagle Point deposits will ensure sufficient reserves to feed the Rabbit Lake mill into the next century.

JAPAN

Kansai Electric Power Company and six other Japanese utilities recently concluded their annual price negotiations for deliveries under long-term uranium supply contracts with South Africa's Nuclear Fuels Corporation (NUFCOR). The utilities agreed to pay approximately US$30.50 per pound U_3O_8 for fiscal year 1987 deliveries (ending March 31, 1987). This represents a reduction of about $2.00 per pound from the price paid for FY86 deliveries.

The annual price negotiations are primarily influenced by developments in the spot and near-term prices over the entire previous year, as opposed to the few months before the negotia-

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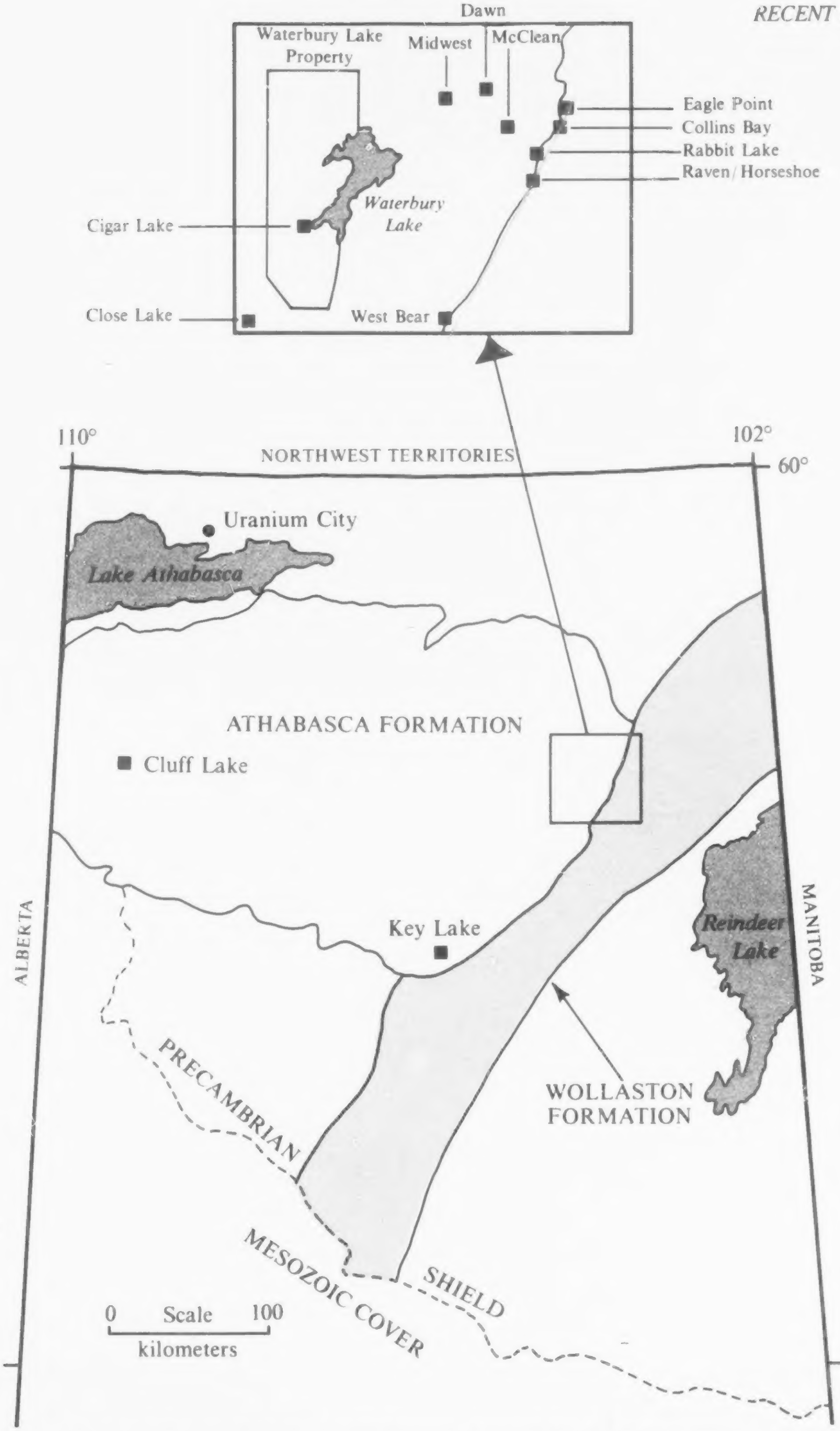
Dawn
Waterbury Lake Property
Midwest
McClean
Eagle Point
Collins Bay
Rabbit Lake
Raven/Horseshoe
Waterbury Lake
Cigar Lake
Close Lake
West Bear
110°
102°
NORTHWEST TERRITORIES
60°
Uranium City
Lake Athabasca
ATHABASCA FORMATION
Cluff Lake
Key Lake
ALBERTA
MANITOBA
Reindeer Lake
WOLLASTON FORMATION
PRECAMBRIAN
SHIELD
MESOZOIC COVER
0 Scale 100
kilometers
55°

Figure 7. Location map of northern Saskatchewan, showing the Eagle Point uranium deposit and others in the district.

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tions. Thus, the weak market conditions prevailing during the first half of 1985 which led to a $14.25 Exchange Value in April probably had as much influence on the negotiations as did the steady strengthening of the market during the last six months of 1985.

The $2.00 drop for FY87 is particularly significant when compared with the total decline of only $3.00 under the delivery contracts from FY83 to FY86. While the low market prices prevalent during the first half of 1985 undoubtedly affected the negotiations, weakening energy prices worldwide also had an influence to some degree. Table 1 shows a comparison for the past seven years of annually negotiated prices versus average Exchange Values, including a ratio of negotiated price to average Exchange Value. The increasing ratios demonstrate that, at least until the latest negotiations, Exchange Values had fallen at a much greater rate than had the negotiated prices.

Table 1

RESULTS OF ANNUAL JAPANESE URANIUM PRICE NEGOTIATIONS COMPARED TO EXCHANGE VALUE

Fiscal Year Ending March 31	Approximate Agreed Price ($/lb. U_3O_8)	Average E.V. for Preceding Japan FY ($/lb. U_3O_8)	Ratio of Delivery Price to Average E.V.
1981	45.00	41.17	1.1
1982	37.75	28.63	1.3
1983	35.50	23.65	1.5
1984	33.70	19.65	1.7
1985	33.50	22.10	1.5
1986	32.50	16.44	2.0
1987	30.50	15.94	1.9

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PRIMARY MARKET CONVERTERS — BRITISH NUCLEAR FUELS plc

Introduction

British Nuclear Fuels plc (BNFL) provides a variety of fuel cycle services and is one of the five primary market conversion suppliers in the world (Table 2). The company converts natural uranium concentrates to UF_6 at its plant in Springfields, Lancashire (Figure 8). In addition to UF_6 conversion, BNFL provides enrichment (through its majority ownership share in Urenco Limited's Capenhurst plant), UO_2 conversion, fuel fabrication, reprocessing, and waste management. These functions are administered by four divisions; Fuel Division, Enrichment Division, Reprocessing Operations, and Reprocessing Engineering Division, the latter responsible for the design and construction of plants employing new reprocessing technologies. The company also owns and operates the nation's first two commercial nuclear power plants, the four-unit Calder Hall Gas-cooled Reactor (GCR) station on the Sellafield site, and the four-unit Chapelcross GCR station in Dumfriesshire, Scotland.

BNFL was created as a private limited company in 1971 out of the former Production Group of the United Kingdom Atomic Energy Authority. Following a period of commercial expansion in the 1970s, BNFL became a public limited company in 1984, and all shares are now owned by the British government. Traditionally, the Central Electricity Generating Board (CEGB) and South of Scotland Electricity Board (SSEB) have been the company's largest customers, purchasing Magnox and Advanced Gas-cooled Reactor (AGR) fuel elements for some 38 operating reactors in the UK.

Concentrate Sampling

Natural uranium concentrates normally arrive by ship or rail at the Springfields site and undergo sampling procedures to determine purity, weights and assays. BNFL employs the auger sampling method, in which an auger pipe 45-millimeters in diameter is inserted the full depth of the drum and is discharged into a sample container. Samples are distributed to the parties involved, and the analysis results are final if both of the parties agree to within 0.3 percent. If the parties do not agree to within that tolerance, an independent analysis is initiated.

Conversion to UF_4

BNFL, like most converters, uses the wet conversion process (Figure 9). This begins with the dissolution of uranium concentrates in nitric acid to produce a slurry containing impure uranyl nitrate and undissolved impurities. A series of continuous mixer-settler extractors filters the impurities, and tributyl phosphate (TBP) in kerosene is used to extract the uranyl nitrate. Some of the impurities removed, such as boron and cadmium, have high neutron capture cross sections, and would inhibit reactivity. Other impurities form volatile fluorides, which can contaminate the UF_6 produced in later stages. The purified uranyl nitrate is then concentrated by evaporation.

BNFL uses fluidized-bed reactors to thermally decompose the uranyl nitrate liquor at temperatures of 300-350 degrees C., forming UO_3. The nitrous fumes are removed and piped to a nitric acid recovery plant. The UO_3 is converted to UF_4 using the rotary kiln process, which consists of three main sections:

1. The hydration of the UO_3;
2. The reduction of the hydrate to UO_2;
3. The hydrofluorination of the UO_2 to UF_4.

In the hydration process, dilute nitric acid and a wetting agent are added to UO_3 to produce a slurry. The slurry gradually is dried in the hydrator. In powder form, the UO_3 hydrate is fed into the reduction kiln, where it reacts with a counter-current flow of hydrogen to produce UO_2. Offgases are filtered and scrubbed.

Table 2

FREE WORLD CONVERTERS

Company	Plant Location	Production Capacity (MTU as UF_6 per year)
Allied Corporation	Metropolis, Illinois	12,700
Comurhex	Pierrelatte, France	12,500
BNFL[1]	Springfields, UK	9,500
Sequoyah Fuels	Gore, Oklahoma	9,100
Eldorado Resources Ltd.	Port Hope, Ontario, Canada	9,000[2]

[1] British Nuclear Fuels plc.

[2] An older conversion facility with a nameplate capacity of 4,500 MTU as UF_6 per year is not currently in service.

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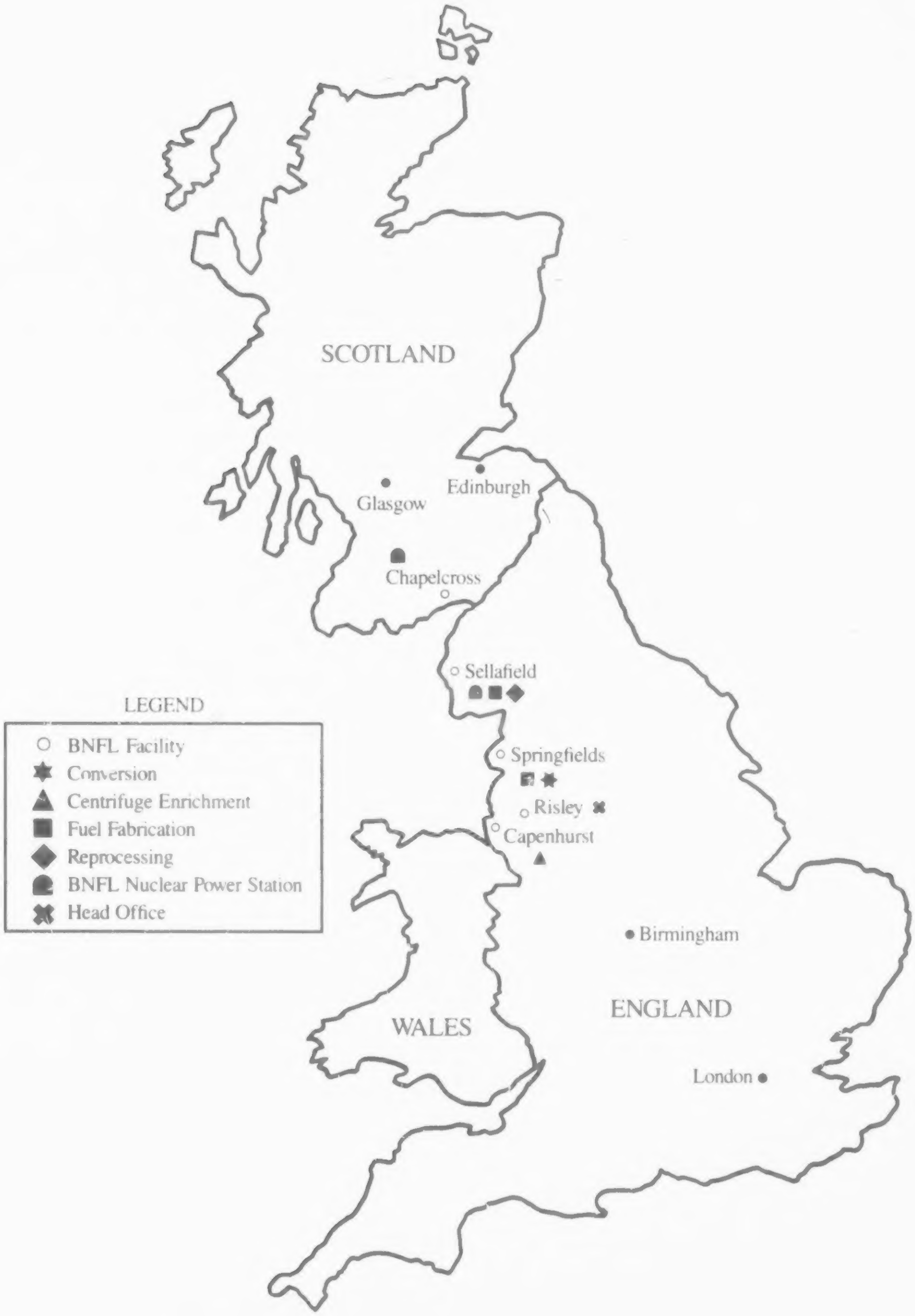
SCOTLAND
Glasgow
Edinburgh
Chapelcross
Sellafield
Springfields
Risley
Capenhurst
Birmingham
WALES
ENGLAND
London
LEGEND
○ BNFL Facility
✶ Conversion
▲ Centrifuge Enrichment
■ Fuel Fabrication
◆ Reprocessing
BNFL Nuclear Power Station
✖ Head Office

Figure 8. Location map of BNFL sites in the United Kingdom.

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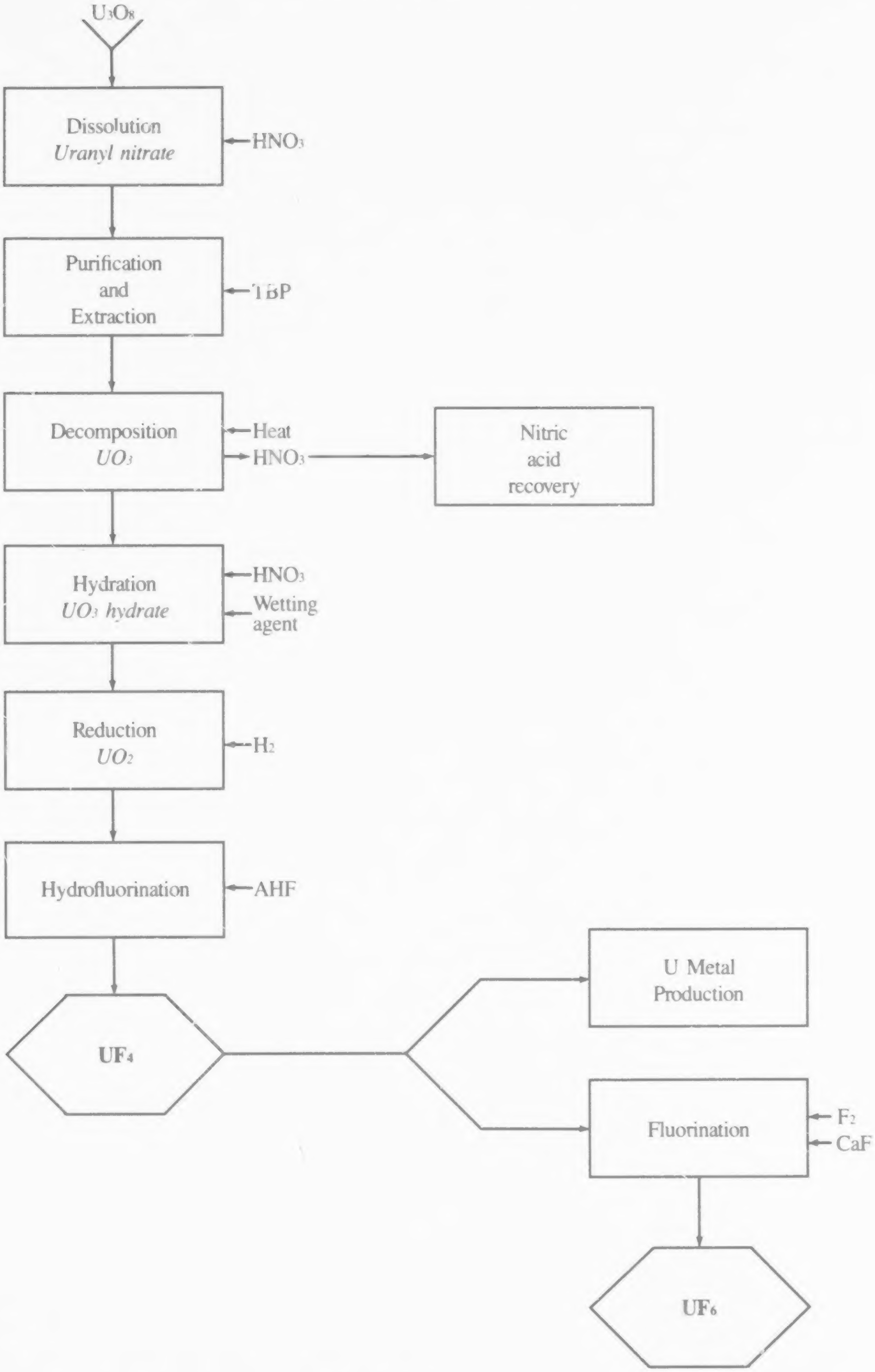
Figure 9. BNFL CONVERSION PROCESS


U_3O_8
Dissolution
Uranyl nitrate
HNO_3
Purification and Extraction
TBP
Decomposition
UO_3
Heat
HNO_3
Nitric acid recovery
Hydration
UO_3 hydrate
HNO_3
Wetting agent
Reduction
UO_2
H_2
Hydrofluorination
AHF
UF_4
U Metal Production
Fluorination
F_2
CaF
UF_6

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The UO_2 product is then fed to hydrofluorination kiln. The UO_2 powder passes through five zones in the kiln, where it reacts with a counter-current flow of anhydrous hydrogen fluoride gas, producing UF_4. Forced air coolers maintain proper temperatures during the exothermic reaction. Offgases from the kiln are filtered, condensed and scrubbed. The UF_4 product is stored in preparation for transfer to the UF_6 conversion plant.

Part of the UF_4 output is reduced to uranium metal using magnesium. The uranium metal is used for replacement Magnox reactor fuel elements (Figure 10).

UF_6 Production

The reaction of UF_4 with elemental fluorine produces UF_6. BNFL currently utilizes two UF_6 production units; the first was commissioned in 1968 and has a capacity of 3,000 MTU annually, and a 6,500 MTU per year unit was commissioned in 1974. The units are operated from a single control room. Fluorine gas is produced by electrolysis of a fused salt at 85-90 degrees C.

The UF_4 reacts with fluorine gas in a fluidized bed reactor containing an inert bed of calcium fluoride granules. The reaction is highly exothermic, and the calcium fluoride prevents sintering of the UF_4 within the reactor. Forced-air cooling maintains the temperature of the fluidized bed at about 450 degrees C. The gaseous UF_6 product is filtered and passed through a series of condensers, where it cools to a solid. The condensers are reheated to liquify the UF_6, which is transferred to transit containers. BNFL owns a variety of transport cylinders to meet the requirements of UF_6 traffic worldwide.

Some of the UF_6 produced at Springfields is transported in 48-inch diameter cylinders to Urenco's Capenhurst enrichment facility. The remainder is shipped to the other enrichment plants worldwide, including Techsnabexport in the USSR.

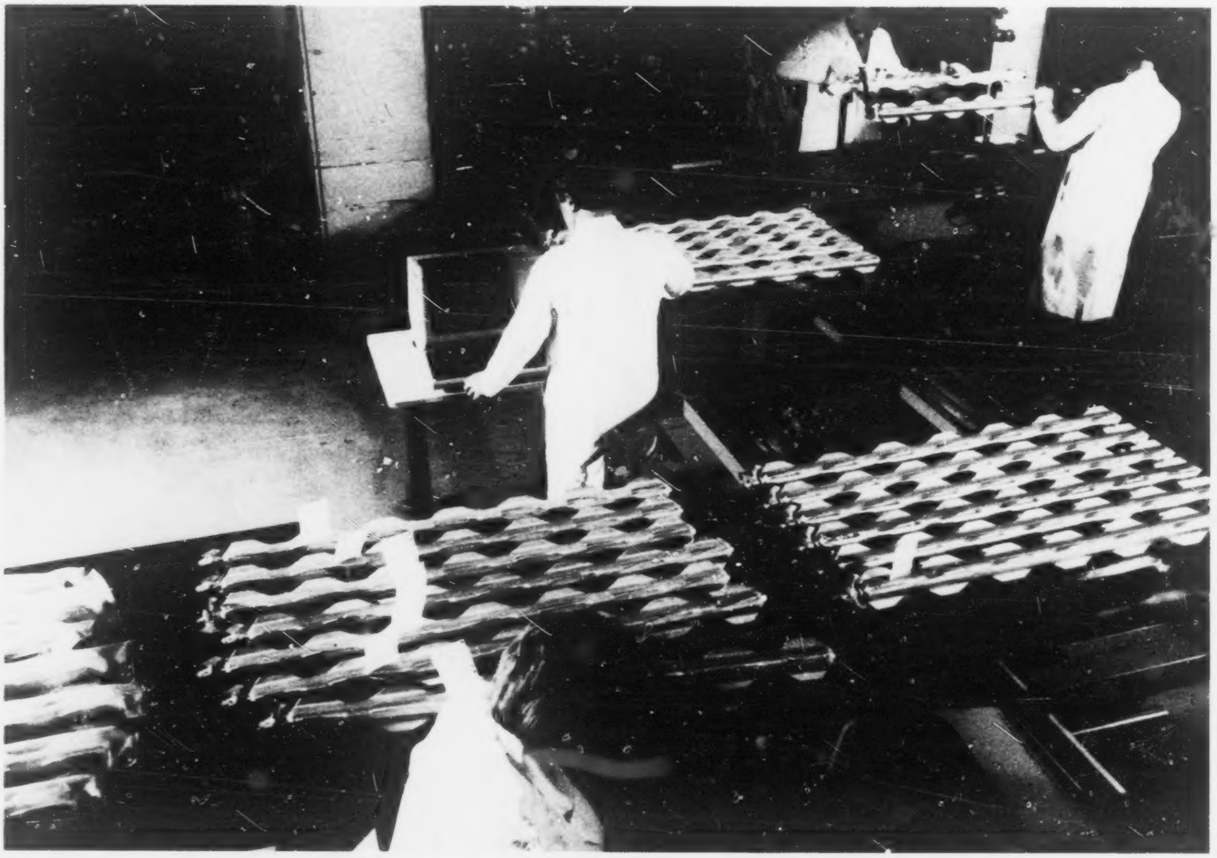

Figure 10. Final inspection of Magnox fuel elements at the Springfields facility.

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Marketing

Despite weakness in the conversion market worldwide, chiefly due to overcapacity, BNFL's wide range of services allows considerable flexibility. Current UF_6 production totals about 7,500 metric tons uranium annually. About 90 percent of its UF_6 production is destined for overseas end-users, primarily in Europe and the Far East. To date, only a few US utilities have contracted with BNFL for conversion services. This may in part be due to the fact that much of US utilities' uranium supply comes from North America and can be converted at one of the three North American converters.

During 1985, BNFL obtained new business in the USA, France, the Federal Republic of Germany, Spain, Italy and Japan for its entire scope of Fuel Division services. This business, totaling about 100 million pounds sterling (approximately US$145 million), included UF_6 production, fuel manufacturing and technology licensing. The Integrated Dry Route (IDR) process for the conversion of UF_6 to UO_2 powder was developed at Springfields and has been licensed to European and US fuel fabricators. In terms of total operations, including enrichment, reprocessing, and front-end fuel services, foreign orders accounted for about 23 percent of BNFL's total business in FY 1985. Most of this 23 percent was split between the Far East (11 percent) and Europe (10 percent); North and South America accounted for the remaining two percent of orders.

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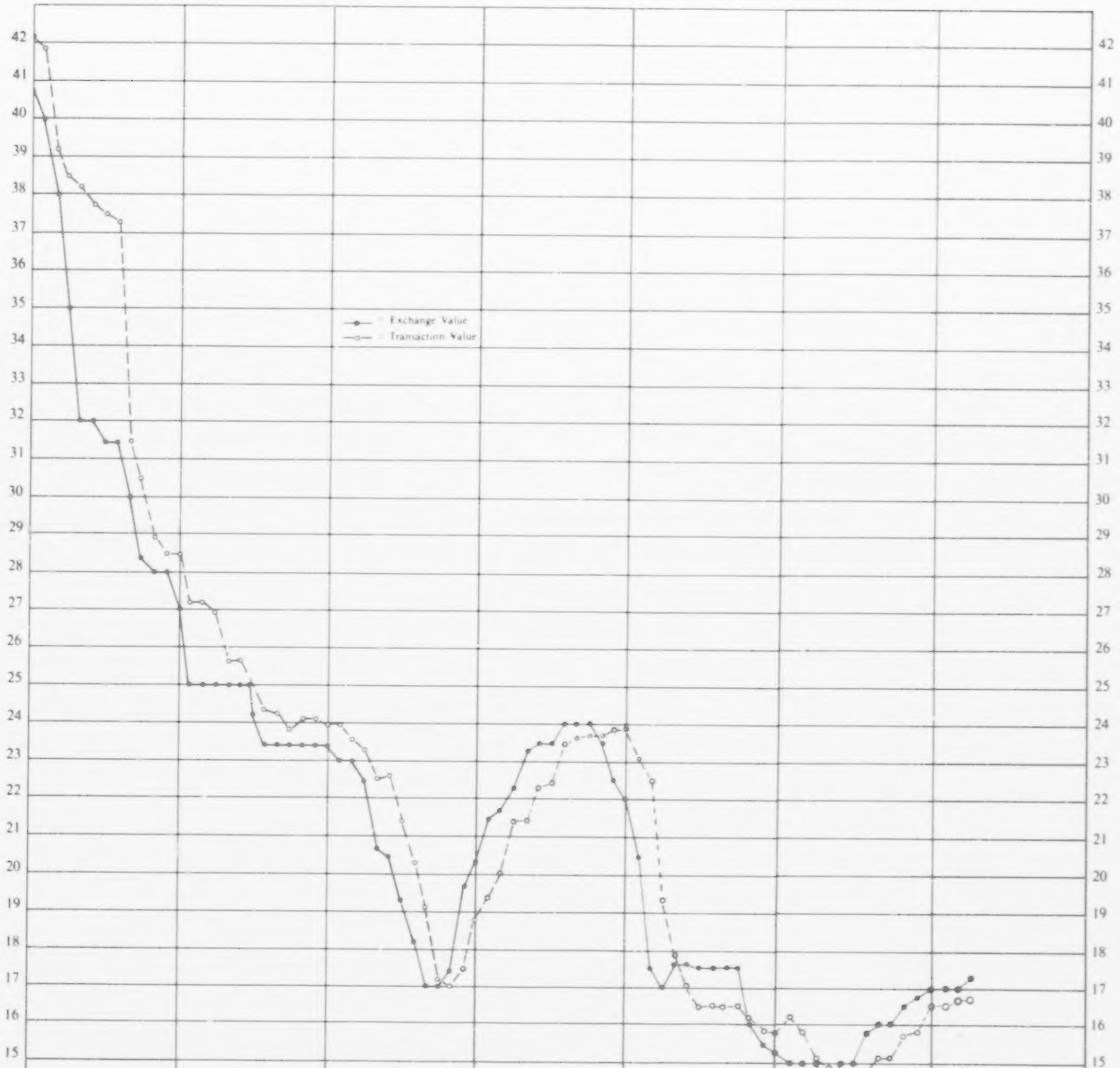
HISTORICAL MARKET DATA

EXCHANGE AND TRANSACTION VALUES SINCE JANUARY 1980

Determined as of the last day of the month indicated



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HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	32.50	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	**17.25**									

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	**16.70**									

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U in UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	**1.80**									

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GOVERNMENT STATISTICS

AUSTRALIA

	Price Index of Materials Used in Manufacturing Industry — All Groups[1] (1984 = 100)	Award Rates of Pay Indexes Australia — Adult Males In Mining Wage Earners, Weekly Rates[2] (1976 = 100)
1975 Avg.	150.4	132.6
1976 Avg.	168.4	160.9
1977 Avg.	192.0	179.0
1978 Avg.[3 4]	198.5	190.0
1979 Avg.	248.8	127.9
1980 Avg.	321.8	140.8
1981 Avg.	355.3	154.1
1982 Avg.[5]	368.6	174.9
1983 Avg.	401.6	181.8
Jan 1984	94.6R	188.5R
Feb 1984	95.4R	188.4R
Mar 1984	95.7R	188.2R
Apr 1984	95.8R	196.1R
May 1984	95.7R	197.0R
Jun 1984	95.9R	197.4R
Jul 1984	96.7R	197.4R
Aug 1984	97.9R	197.4R
Sep 1984	97.6R	197.4R
Oct 1984	96.8R	197.4R
Nov 1984	96.4R	197.4R
Dec 1984	96.2R	197.4R
FY84 Avg.[6]	95.3R	—
FY85 Avg.[6]	100.0R	—
Jan 1985	97.0R	197.4R
Feb 1985	98.6R	197.4R
Mar 1985	102.1R	197.4R
Apr 1985	104.4R	202.4R
May 1985	107.6R	202.4R
Jun 1985	108.7R	202.4R
Jul 1985	111.0R	202.4R
Aug 1985	110.5R	202.4R
Sep 1985	108.9R	202.5R
Oct 1985	109.6R	202.4R
Nov 1985	109.6R	209.8R
Dec 1985	110.2	209.9R
Jan 1986	109.8	209.9

P = Preliminary R = Revised since last month

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[1] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0). The basis of this index was revised to 1984 = 100. The previous index was 1969 = 100.

[2] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

[3] Monthly data for 1970-78 appear on pages 4.7 and 4.8 of Report 138.

[4] Annual averages prior to 1979 reflect index base no longer in use.

[5] Monthly data for 1979-82 appear on page 35 of Report 184.

[6] Annual averages are for financial year ending June 30.

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CANADA

	Industry Selling Price Index: All Commodities[1] (1981 = 100)	Wage-earner Data: Average Hourly Earnings (C$)[2]					
		Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells[3] (SIC 051-099)	Primary Non-ferrous Metal Industries[4] (SIC 296)	(SIC 298)	Chemicals and Chemical Products[5] (SIC 370-379)
1979 Avg.[6]	217.9	—	9.60	9.66	—	—	7.67
1980 Avg.	247.2	—	10.58	10.80	—	—	8.50
1981 Avg.	288.7	—	12.02	12.23	—	—	9.53
1982 Avg.[7]	288.8	—	13.74	13.92	—	—	10.63
1983 Avg.	298.8	—	—	14.30	—	—	11.17
Jan 1984	305.4	17.74	15.27	14.74	11.91	10.84	11.69
Feb 1984	306.6	17.90	15.59	14.90	12.04	10.82	11.51
Mar 1984	308.7	18.05	15.52	14.82	12.14	10.84	11.58
Apr 1984	310.5	18.06	15.83	15.10	11.96	10.34	11.63
May 1984	310.6	18.48	15.64	15.06	12.11	10.16	11.65
Jun 1984	311.0	18.08	15.48	14.80	12.38	10.40	11.66
Jul 1984	312.9	17.81	15.72	14.92	12.53	10.18	11.82
Aug 1984	312.7	17.24	15.36	14.92	12.44	10.34	11.78
Sep 1984	312.3	17.68	15.96	15.34	12.51	10.52	11.90
Oct 1984	312.3	17.64	16.15	15.26	12.69	10.56	11.96
Nov 1984	313.6	18.04	16.13	15.43	12.47	10.51	11.96
Dec 1984	314.2	17.95	16.39	15.60	12.16	10.40	11.99
1984 Avg.	310.9	17.88	—	15.07	12.28	10.49	11.76
Jan 1985	117.5R	18.05	16.13	15.60	12.32	10.80	12.04
Feb 1985	117.7R	18.78	16.41	15.68	12.52	11.05	12.06
Mar 1985	118.4R	18.24	16.21	15.57	12.44	10.97	12.02
Apr 1985	118.3R	18.63	16.44	15.80	12.81	11.23	12.04
May 1985	118.6R	19.41	16.51	15.63	12.76	11.25	12.15
Jun 1985	118.6R	18.49	16.20	15.49	12.89	11.14	12.14
Jul 1985	118.6R	18.14	16.27	15.41	12.96	11.17	12.13
Aug 1985	118.4R	17.07	16.03	15.30	12.97	11.31	12.19
Sep 1985	118.6R	18.53	16.55	15.72	12.95	11.39	12.26
Oct 1985	118.9R	18.74	16.51	15.70	13.14	11.53	12.33
Nov 1985	119.2R	19.05	16.66	15.88	12.76	11.32	12.49
Dec 1985	119.9R	19.07R	16.57R	16.01R	12.51R	11.09R	12.59R
Jan 1986	120.7P	18.67P	16.44P	15.98P	12.80P	11.37P	12.53P
Feb 1986	120.5P						

P = Preliminary R = Revised since last month

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[1] Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Index prior to 1985, 1971 = 100.

[2] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours" (Catalogue 72-002).

[3] Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

[4] Beginning with the April 1983 figure, Primary Metal Industries, non-ferrous is split into SIC 296 and SIC 298.

[5] Chemical and Chemical Products prior to April 1983 was SIC 370-379. The new series is from a new survey which includes all companies and is based on a 1970 classification. The old survey only included companies of 20 employees or more.

[6] Monthly ISPI for 1977 and 1978 appear on page 4.10 of Report 138, and monthly wage-earner data for 1973-78 appear on page 4.11 of Report 138.

[7] Monthly data for 1979-1982 appear on page 37 of Report 184. On that page, the wage earner index entitled "Metal Mining, Including Milling (SIC 050-099)" should read "Total Mining (SIC 051-099)."

[8] Beginning with the April 1983 figure, Wage Earner Data are based on a census of all companies employing 200 or more wage earners, *plus* a random survey of companies employing fewer than 200 wage earners. Prior to April 1983 only companies employing 200 or more wage earners are included in the Wage Earner Data.

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GOVERNMENT STATISTICS

REPUBLIC OF SOUTH AFRICA

		Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1]	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100)[2]	Consumer Price Index[3] (1980 = 100)[4]	Producer Price Index All Groups[5] (1980 = 100)	Total Employment in Mining and Quarrying (Code 35)[6]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[6]
1975	Avg.	16.71	—	157.2	100.0	639,473	1,003,617
1976	Avg.	19.30	—	174.7	115.1	671,240	1,212,983
1977	Avg.	23.87	—	194.4	130.0	712,006	1,420,670
1978	Avg.	27.14	—	137.2	142.7	664,571	1,537,169
1979	Avg.[7]	30.18	—	155.3	164.5	692,209	1,830,632
1980	Avg.[8]	35.53	—	176.7	192.1	714,379	2,279,615
1981	Avg.	41.89	—	206.5	218.3	728,506	2,820,505
1982	Avg.[9]	47.25	104.2	233.5	248.7	707,552	3,246,071
1983	Avg.	51.87	115.0	262.2	274.8	696,579	3,644,772
Jan	1984	—	—	274.7	283.3	689,807	326,619
Feb	1984	—	—	278.4	286.5	702,553	335,906
Mar	1984	55.30	123.1	281.9	288.0	715,628	342,332
Apr	1984	—	—	286.1	290.2	712,963	327,550
May	1984	—	—	288.3	292.6	710,040	327,937
Jun	1984	56.95	126.2	291.2	295.3	717,009	347,121
Jul	1984	—	—	295.1	296.0	717,121	369,964
Aug	1984	—	—	297.0	300.8	721,905	361,357
Sep	1984	60.64	133.2	299.9	304.1	721,470	359,218
Oct	1984	—	—	303.7	308.7	717,865	363,755
Nov	1984	—	—	307.4	312.8	717,396	369,771
Dec	1984	62.92	138.6	309.4	315.9	701,198	365,234
Jan	1985	—	—	177.1	166.6	711,366	376,777
Feb	1985	—	—	182.8	171.3	727,932	361,823
Mar	1985	64.48	142.4	183.6	173.0	708,809	371,380
Apr	1985	—	—	187.4	174.0	724,187	369,005
May	1985	—	—	189.5	177.7	708,085	373,478
Jun	1985	67.42	148.9	191.9	179.2	724,587	395,543
Jul	1985	—	—	193.6	180.7	738,228	419,106
Aug	1985	—	—	195.6	183.2	734,121	416,777
Sep	1985	70.47	155.3	197.8	184.8	732,836	419,883
Oct	1985	—	—	200.8	188.1	720,071	—
Nov	1985	—	—	203.4	196.0	750,049	—
Dec	1985	72.43	160.1	207.4	199.4	740,895	—
Jan	1986	—	—	213.8	203.6	—	—
Feb	1986	—	—	215.8	203.6	—	—

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[1] Chamber of Mines of South Africa, Johannesburg, "Analysis of Working Results," published quarterly.

[2] Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

[3] Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."

[4] The basis for calculation prior to January 1985, 1975 = 100. For annual averages prior to 1978, April 1970 = 100.

[5] Previously known as the Wholesale Price Index, now the Producer Price Index. The computation remains the same. The basis for calculation prior to January 1985, 1975 = 100.

[6] Bulletin of Statistics, Department of Statistics, Pretoria.

[7] Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 4.9 of Report 140.

[8] Monthly data for Codes 35 and 40, 1977-1980, appear on page 28 of Report 157.

[9] Monthly data for 1979-82 appear on page 39 of Report 184.

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UNITED STATES

	Producer Price Index[1]		Consumer Price Index[2]	GNP Implicit Price Deflator[3,4]	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[5]			
	Industrial Commodities (1967 = 100)	All Commodities (1967 = 100)	(1967 = 100)	(1982 = 100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980 Avg.[6]	274.8	268.8	246.8	178.64	10.26	10.63	8.30	6.94
1981 Avg.	304.1	293.4	272.4	195.51	11.55	11.98	9.12	7.62
1982 Avg.[7]	312.3	299.3	289.1	207.15	12.33	12.94	9.96	8.21
1983 Avg.	315.8	303.1	298.4	215.63	12.57	13.43	10.59	8.65
1984 Avg.	322.6	310.3	311.1	108.1	13.05	13.43	11.08	9.04
Jan 1985	322.9	309.5	316.1	—	13.29	13.70	11.39	9.33
Feb 1985	322.5	309.2	317.4	—	13.30	13.73	11.39	9.33
Mar 1985	322.6	308.7	318.8	110.4	13.29	13.95	11.37	9.39
Apr 1985	323.8	309.3	320.1	—	13.43	13.62	11.48	9.40
May 1985	325.3	309.8	321.3	—	13.24	13.59	11.46	9.39
Jun 1985	324.8	309.2	322.3	111.3	13.23	13.66	11.52	9.46
Jul 1985	324.4	309.0	322.8	—	13.45	13.82	11.60	9.47
Aug 1985	323.7	307.3	323.5	—	13.55	13.69	11.62	9.50
Sep 1985	322.3R	305.5R	324.5	112.1	13.44	13.66	11.67	9.55
Oct 1985	324.2R	307.9R	325.5	—	13.49	13.64	11.72	9.56
Nov 1985	325.0	309.7	326.6	—	13.49	13.95	11.82	9.61
Dec 1985	325.2	310.2	327.4	113.0	13.43R	13.78R	11.87R	9.68R
Jan 1986	324.0	309.0	328.4	—	13.43P	13.69P	11.86P	9.62P
Feb 1986	319.4	304.7	327.5	—	—	—	11.84P	9.60P
Mar 1986	—	—	—	113.0	—	—	—	—

P = Preliminary R = Revised since last month

[1] US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

[2] US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items.

[3] US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

[4] The basis for calculation of this index was revised to 1982 = 100. 1984 and 1985 figures have been adjusted to that basis. The basis for calculation prior to 1984, 1972 = 100.

[5] US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for 1977-1978 are adjusted to the March 1979 benchmark. Data for January 1979 and beyond are adjusted to the March 1980 benchmark.

[6] Monthly data 1970-1978 for Producer Price Index-Industrial Commodities, Consumer Price Index, and Employment and Earnings SIC codes 10, 333, and 28, and quarterly data for GNP Implicit Price Deflator appear on pages 4.6-4.8 of Report 139.
Monthly data 1977-1978 for Employment and Earnings SIC Codes 10, 333, and 28 appear on page 33 of Report 147.
Monthly data 1970-1978 for Employment and Earnings SIC Code 36 appear on page 23 of Report 154.
Monthly data 1977-1980 for Producer Price Index-All Commodities, appear on page 21 of Nuexco Report 158.

[7] Monthly data 1979-1982 for all listed indices appear on page 41 of Report 184.

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NUEXCO

REPRESENTATIVES AND CONSULTANTS

AUSTRALIA

Peter Stork
Oratom Consulting
5 Gould Ave.
St. Ives
NSW 2075, Australia
Telephone: (61-2) 449-6783
Telex: AA123976 (COMTLX)

JAPAN

Kazy Yokota
Japan Tech Services
Ohkura Building (3F)
1-4-10 Shiba Daimon
Minato-ku, Tokyo, Japan
Telephone: (81-3) 431-6031, 6025
Telecopy: (81-3) 434-6674
Telex: 242-5060 (JATECH J)

SOUTH AFRICA

Chris I. Von Christierson
Southern Prospecting (Pty) Limited
P.O. Box 61409
Marshalltown 2107
Republic of South Africa
Street Address:
10th Floor
Eagle Star House
70 Fox Street
Johannesburg 2001
Telephone: (27-11) 838-1868
(27-11) 834-4211
Telecopy: (27-11) 834-3148
Telex: 4-89878 SA

TAIWAN

Edward Bee
Bee & Liang Company, Ltd.
14 FL Universal Business Center
NO. 663, Tun Hwa South Road
P.O. Box 1396
Taipei, Taiwan R.O.C.
Telephone: (886-2) 704-9630
TWX: 785-11570 (BEELIANG)

UNITED STATES

Harold C. Lindberg
83-A Hardee Lane
Whispering Pines, N.C. 28327
Telephone: (919) 949-3622

M. Jerry Reaves
Suite 500
Seven Piedmont Center
Atlanta, Georgia 30305
Telephone: (404) 262-7375

Ralph O. Smith
141 Braemar Drive
Cheshire, Connecticut 06410
Telephone: (203) 272-6246

SPECIAL CONSULTANTS

George J. Stathakis
International Investment Banking

James C. C. Stewart
U.K. Nuclear Industry

Claus C. Thiesen
Japan Nuclear Industry

W. Bryan Webster
International Business Development

J. Robert Wolcott
International Business Development

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EXECUTIVE SUMMARY
REPORT 212
(All data as of March 31, 1986)

Exchange Value
\$17.25, up \$0.25

The **Exchange Value** is **\$17.25** per pound U_3O_8, up \$0.25 since last month.

UF_6 Value
\$48.00, unchanged

The **UF_6 Value** is **\$48.00** per kilogram U as UF_6, unchanged since last month.

Transactions

Three recent natural uranium sales and two of enriched uranium are reported, involving approximately 500 thousand pounds equivalent U_3O_8. All of the sales involved spot or near-term delivery and two met the conditions for inclusion in the Transaction Value. Three transactions involved natural UF_6.

Supply-Demand Ratio
increased to 2.7:1

Active spot and near-term **uranium supply** amounts to **2.5 million** pounds U_3O_8 equivalent, up 120 thousand pounds since last month. Active spot and near-term **uranium demand** totals **950 thousand** pounds, down 25 thousand pounds. The spot and near-term **supply-demand ratio** rose to **2.7:1.**

Transaction Value
\$16.70, unchanged

The **Transaction Value** is **\$16.70** per pound U_3O_8, unchanged since last month. The calculation includes 18 transactions involving a total of 2.7 million pounds U_3O_8 and equivalent UF_6, and covers a period of 6 months.

Loan Rate
unchanged at 5%

The **Loan Rate** is **5 percent** per annum, unchanged.

Conversion Value
\$1.80, unchanged

The **Conversion Value** is **\$1.80** per pound U as UF_6, unchanged since last month. Active secondary market supply for conversion services for delivery within three years totals 975 thousand pounds U as UF_6. Active demand totals 950 thousand pounds U as UF_6. No secondary market conversion transactions are reported.

SWU Value for
delivery within
one year: \$80

The **SWU Value** at .3 tails and for delivery within one year is **\$80** per SWU, unchanged since last month. Three secondary market SWU transactions are reported, involving approximately 100 thousand SWUs.

* * *

Raw Materials

Following a year-long test program, Chevron Resources company recently announced that it will proceed with commercial production at its Mount Taylor uranium mine near Grants, New Mexico. Chevron expects that the project, which contains an estimated 120 million pounds of reserves, will yield about 1.5 million pounds U_30_8 per year.

Australia

The Northern Land Council has initiated a complex legal action against the Australian government and Energy Resources of Australia, alleging that it was forced into signing the agreement by which the Ranger mine was approved. Separately, ERA announced a 15-percent decline in profits in the second half of 1985.

Canada

Eldorado Resources Limited recently announced increased uranium reserve estimates at the Eagle Point deposits, near its Rabbit Lake mill in northern Saskatchewan. Development of the project is expected to result in additional feed for the Rabbit Lake mill.

Japan

Kansai Electric Power Company and six other Japanese utilities recently concluded annual price negotiations for deliveries under long-term uranium supply contracts with South Africa's Nuclear Fuels Corporation (NUFCOR). The utilities agreed to pay approximately US\$30.50 per pound U_30_8 for fiscal year 1987 deliveries, a reduction of about \$2.00 from the price paid for 1986 deliveries.

Focus

British Nuclear Fuels plc (BNFL) provides UF_6 conversion services for the world market, and ranks third among the five free world converters in nameplate capacity. In addition, BNFL supplies fuel cycle needs in the United Kingdom ranging from conversion to reprocessing.

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NUEXCO REPORT 212 FIGURES OF THE MONTH (March 31, 1986)	This Month (Report 212)	Last Month (Report 211)	12 Months Ago (Report 200)
Exchange Value[1]	17.25	17.00	15.00
Transaction Value[1]	16.70	16.70	15.05
UF_6 Value[2]	48.00	48.00	—
Loan Rate[3]	5%	5%	5%
Conversion Value[4]	1.80	1.80	1.00
Near-Term Uranium Supply[5]	2.5	2.4	4.3
Near-Term Uranium Demand[6]	1.0	1.0	4.1
Near-Term Supply-Demand Ratio	2.7	2.5	1.0
Recent Uranium Sales:			
Number of Transactions[7]	5	5	11
Quantity of Material[8]	0.5	1.0	2.1
Nuexco SWU Value:[9]			
at 0.3 tails assay and delivery within one year	80	80	—
USDOE SWU Prices:			
USEC	125.00[10]	125.00[10]	135.00
AFC	153.00[11]	153.00[11]	153.00[11]
Requirements	157.00[11]	157.00[11]	157.00[11]
Market Value of Enriched UF_6[12,13]:			
2.5 w/o U_{235}	466	462	471
3.0 w/o U_{235}	596	592	608
3.5 w/o U_{235}	729	724	748
4.0 w/o U_{235}	864	858	890

---

[1] US $ per pound U_3O_8 equivalent.

[2] US $ per kilogram U as UF_6.

[3] Per annum.

[4] US $ per pound U as UF_6.

[5] Active inquiries to sell, for delivery within 12 months after contract signing (millions of pounds U_3O_8).

[6] Active inquiries to purchase, for delivery within 12 months after contract signing (millions of pounds U_3O_8).

[7] Uranium sales only; does not include loans, conversion, or SWU transactions.

[8] Millions of pounds U_3O_8, equivalent.

[9] US $ per SWU.

[10] Effective 10/1/85.

[11] Effective 10/1/84.

[12] Calculated using the Nuexco Exchange Value, Conversion Value, and 0.30 percent tails assay. From 4/30/85 to 11/30/85, calculations used in the Nuexco SWU Value for DOE origin and delivery by the end of FY86. As of 12/31/85, calculations use the SWU Value for delivery within one year.

[13] US $ per KgU as UF_6, rounded to the nearest $.

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MAY 1986 NUMBER 213

MONTHLY REPORT

ON THE NUCLEAR FUEL MARKET

NUEXCO

HEADQUARTERS

Three Park Central
1515 Arapahoe Street
Suite 1045
Denver, Colorado 80202
Telephone: (303) 893-4015
Telecopy: (303) 825-4821
Telex: 450202 (NUEXCO DVR)

Chairman of the Board of Partners
Oren L. Benton

Vice Chairman of the Board of Partners
Samuel R. Freeman

EASTERN UNITED STATES

100 Prospect Street
Century Plaza South
Stamford, Connecticut 06901
Telephone: (203) 323-1999
Telecopy: (203) 325-1483
Telex: 4750124 (NUEXCO C)

Managing Broker
Earl E. Hoellen, Jr.

WESTERN UNITED STATES

Building 3, Suite 290
3000 Sand Hill Road
Menlo Park, California 94025
Telephone: (415) 854-1510
Telecopy: (415) 854-2115
Telex: 470674 (NUEXCO UI)

Managing Broker
George White, Jr.

EUROPE

13 chemin du Levant
01210 Ferney-Voltaire
France
Telephone: (33-50) 428035
Telecopy: (33-50) 428526
Telex: 385288 (NUEXCO F)

Managing Broker
James E. Vaughan

REGIONAL MANAGING BROKERS

AFRICA
James E. Vaughan

AUSTRALIA
George White, Jr.

CANADA
Wayne D. Fowler
(303) 893-4015

FAR EAST
Christian C. Guitton
(415) 854-1510

MEXICO AND SOUTH AMERICA
Earl E. Hoellen, Jr.

(See inside back cover for list of Representatives and Consultants)

NUEXCO

MONTHLY REPORT ON THE NUCLEAR FUEL MARKET

May 1986 No. 213

GEORGE WHITE, JR., *EDITOR* CLARK M. BEYER, *ASSOCIATE EDITOR*

PRICING

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Page 1
May 1986
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PRICING

NATURAL URANIUM AND SECONDARY MARKET CONVERSION

(All data as of April 30, 1986)

The **Exchange Value** is **$17.25** per pound U_3O_8, unchanged since last month. **Active supply** of natural uranium (concentrates and UF_6) for spot or near-term delivery totals **2,590,000** pounds U_3O_8 equivalent, up 65 thousand pounds since last month. The corresponding figure for **active demand** is **1,225,000** pounds, up 275 thousand pounds. The spot and near-term **supply-demand ratio** declined to **2.1:1.**

The *Current Market Data* section of this Report lists six natural uranium sales, involving approximately 1.4 million pounds equivalent U_3O_8. Five of the transactions involved near-term delivery and five met the criteria for inclusion in the current Transaction Value calculation. Four transactions involved natural UF_6.

The **Transaction Value** is **$17.10** per pound U_3O_8, up $0.40 since last month. The calculation extends over a 5-month period and includes 19 transactions involving 2.3 million pounds equivalent U_3O_8. The sizeable rise in the Transaction Value is due to the removal from the calculation of October and November 1985 transactions. Those transactions involved over one million pounds equivalent U_3O_8 at prices around $16.25.

The **UF_6 Value** is **$48.50** per kilogram U in UF_6, up $0.50 since last month.

The **Conversion Value** is **$1.90** per pound U in UF_6, up $0.10 since last month. Active supply of secondary market conversion services for delivery within three years totals 825 thousand pounds U as UF_6. Active demand totals 625 thousand pounds U as UF_6. Two secondary market conversion transactions are reported.

The **Loan Rate** is unchanged at **5 percent** per annum.

* * *

The market for natural uranium concentrates strengthened for a short time in the middle of April, but an abundance of supply and a lack of firm U_3O_8 buyers at the end of the month precluded a rise in the Exchange Value. Several suppliers have expressed cautious interest in offering concentrates at prices near the $17.25 level, but any sellers wishing to dispose of material quickly would probably need to offer some discount in order to complete a sale. Conversely, there may not be enough low-priced supply to meet unanticipated demands for very large quantities of U_3O_8. At present, however, only one potential buyer of concentrates remains in the market and there is no indication that it will act in the immediate future. In general, while some offering prices rose slightly near the end of the month, significant quantities of material at the $17.25 level remained in the market.

The psychological effects of the nuclear plant accident at the Chernobyl station in the USSR (see page 16 of this Report) have yet to cause any specific changes in the uranium market as of this writing. However, a period of uncertainty in the market is inevitable considering the apparent severity of the accident and the worldwide public reaction. Ultimately, if the accident results in additional plant delays or cancellations, both the spot and long-term markets for uranium will be adversely affected.

A recent increase in buyer interest in UF_6 (as compared to U_3O_8) caused some upward movement in the UF_6 Value, which rose to $48.50. Much of the current firm demand is for UF_6. However, several transactions in recent months, including four during April that are reported by Nuexco, have reduced the availability of UF_6, although several utilities remain in the market. In general, demand for concentrates is more discretionary than demand for UF_6, which tends to be based more on immediate reactor requirements than on strategies for inventory purchasing. At least one utility is interested in a large quantity of UF_6 because of such upcoming reactor needs.

* * *

The Conversion Value rose to $1.90 this month in the wake of two secondary market transactions and a third in negotiation. One major seller of a large quantity of conversion services remains in the market, as do a few others offering smaller quantities. Following the probable sale of one utility's inventory, the remaining sellers are highly discretionary, contributing to the upward price movement, and are offering a wide range of prices. Although the algebraic sum of the Exchange Value and Conversion Value exceeds the UF_6 Value by $0.75, UF_6 sellers are reluctant to *deconvert* their material because of uncertainty in the market for concentrates, where demand is thin.

Sequoyah Fuels received authorization to reopen its conversion facility to receive incoming uranium shipments of concentrates and to ship out UF_6 that had been converted prior to the accident. However, its UF_6 conversion operations remain suspended. Nevertheless, the action has relaxed some of the upward price pressure that had been expected in the secondary conversion market. The movement of U_3O_8 into the facility has also reduced the need to arrange uranium swaps to fulfill contractual obligations. Overall, the closure of the facility had less impact on the uranium and secondary conversion market than originally anticipated.

ENRICHED URANIUM AND SWUS

The **SWU Value** as of April 30, 1986, is $80 per SWU. This refers to SWU at a tails assay of 0.30 weight-percent U_{235} and for delivery within one year. Three secondary market SWU transactions are reported this month, involving less than 100 thousand SWUs.

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While several transactions occurred in April at prices near the SWU Value, buyers seeking large quantities of SWU generally have been able to negotiate slightly lower prices. Nevertheless, the market remains very thin; the presence of one potential buyer interested in a large quantity will undoubtedly drive the SWU market until the purchase is made. The potential sellers are discretionary and have exhibited no desire to liquidate their SWU inventories rapidly.

* * *

In early April, Senator Pete Domenici (R, New Mexico) filed his long-anticipated legislation regarding uranium and enrichment in the USA. Entitled "The Uranium Revitalization and Tailings Reclamation Act of 1986," the bill is an attempt to address the problems and conflicting interests facing the uranium and enrichment industries in the USA. It appears that by providing something for all interested parties in an omnibus measure, the authors of the legislation hoped that the bill will be difficult to oppose. Each interest group will achieve certain desired ends if the legislation passes, but the cost to each is acceptance of other provisions that may be deemed undesirable.

Ordinarily, each of these diverse subjects would be the subject of separate legislation, but Senator Domenici, recognizing that passage of such individual bills would be difficult if not impossible, grouped them together into a single package. Proponents of the legislation point out that if the bill is rejected, courts will be forced to decide such matters as the legality of the Utility Services enrichment contract (USEC) and the issue of uranium imports, and no action necessarily will have been taken on the issues of mill tailings and privatization.

A review of the major provisions of the bill and expected positions of various interested parties are outlined in the following table. Others concerned with the outcome of the legislation include non-US enrichers, which would prefer to see DOE forced to charge higher prices, perhaps allowing them additional pricing flexibility. Likewise, governments of uranium-exporting countries will undoubtedly take issue with the 50-percent limitation on uranium imports.

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PROVISION	IN FAVOR	OPPOSED
1. Limit US utility use of non-US origin uranium to 50 percent	— US uranium producers — Some US utilities	— Most US utilities — DOE — US State Dept. — Non-US uranium producers
2. Approval of USEC in its present form	— DOE — Most DOE customers — Most other utilities worldwide	— Some DOE customers
3. Free VTAO between 0.20% and 0.35% U_{235}	— DOE customers — All uranium producers	— DOE — General Accounting Office — US taxpayer lobbies
4. Mill tailings legislation	— US uranium producers	— US utilities
5. Privatization of Enrichment Industry	— DOE — US Congress — Most DOE customers	— Some DOE customers

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CURRENT MARKET DATA

April 30, 1986	Market Values	Active Supply[1] (thousands)	Active Demand[1] (thousands)
EXCHANGE VALUE	**$17.25**/lb. U_3O_8	2,590	1,225
UF_6 VALUE	**$48.50**/kgU		
CONVERSION VALUE	**$1.90**/lb. U as UF_6	825	625
SWU VALUE 0.3 tails assay; delivery within one year	**$80**/SWU		
LOAN RATE	**5%**/annum	0	0

	$/lb. U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
TRANSACTION VALUE	**17.10**	2.3	19	5

[1] Supply and demand tables in *Current Market Data* section of this Report detail the numbers for each category.

DEFINITIONS

1. The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.
2. The **UF_6 Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.
3. The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.
4. The **SWU Value** represents Nuexco's judgment of the price at which transactions for the sale of significant quantities of SWUs of stated origin for delivery in the specified time period could be concluded as of the date indicated.
5. The **Loan Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.
6. The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
   a. Transactions closed within the previous three-month period for which delivery is scheduled within one year of the transaction date;
   b. At least ten transactions;
   c. Transactions involving a sum total of at least 2 million pounds U_3O_8 equivalent.

   The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

DERIVATIONS AND COMMENTS

1. All Market Values are based on:
   a. Data from recently completed transactions.
   b. Data from pending transactions.
   c. Firm bids to buy or borrow, and firm offers to sell or lend.
   d. Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell or lend.
2. Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these Market Values.
3. In the determination of the Conversion Value, Nuexco does not consider transportation charges other than those customarily provided by primary suppliers of conversion services.
4. The prices of conversion services or SWUs delivered under long-term contracts with primary suppliers are not considered in the determination of either the Conversion Value or SWU Value.
5. For the SWU Value, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight-percent U_{235} and a product assay of 3.0 weight-percent U_{235}, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
6. In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

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EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
Country (currency)	**This Month (Apr 30, 1986)**	**Last Month (Mar 31, 1986)**	**12 Months Ago (Apr 30, 1985)**	**This Month (Apr 30, 1986)**	**Last Month (Mar 31, 1986)**	**12 Months Ago (Apr 30, 1985)**
Australia (dollar)	23.31	24.20	21.72	60.60	62.92	56.47
Belgium (comm. franc)	762.95	823.00	891.18	1,983	2,140	2,317
Canada (dollar)	23.79	24.09	19.49	61.84	62.53	50.66
Finland (markka)	84.98	89.33	92.47	220.92	232.24	240.41
France (franc)	119.46	123.66	135.46	310.57	321.48	352.16
FRG (mark)	37.51	40.19	44.36	97.51	104.49	115.34
Italy (lira)	25,723	26,038	28,274	66,875	67,692	73,506
Japan (yen)	2,893	3,098	3,598	7,521	8,052	9,355
Netherlands (guilder)	42.28	45.53	50.09	109.92	118.36	130.22
South Africa (rand)	35.46	35.75	27.75	92.18	92.95	72.15
Spain (peseta)	2,384	2,510	2,492	6,198	6,525	6,479
Sweden (krona)	120.88	126.65	128.49	314.27	329.27	334.06
Switzerland (franc)	31.37	33.56	37.23	81.55	87.25	96.78
UK (pound)	11.14	11.68	11.58	28.97	30.36	30.10
US (dollar)	17.25	17.25	14.25	44.85	44.85	37.05

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
Country (currency)	**This Month (Apr 30, 1986)**	**Last Month (Mar 31, 1986)**	**12 Months Ago (Apr 30, 1985)**	**This Month (Apr 30, 1986)**	**Last Month (Mar 31, 1986)**	**12 Months Ago (Apr 30, 1985)**
Australia (dollar)	23.11	23.43	22.71	60.08	60.91	59.05
Belgium (comm. franc)	756.30	796.76	931.83	1,966	2,071	2,423
Canada (dollar)	23.58	23.32	20.37	61.30	60.63	52.97
Finland (markka)	84.24	86.48	96.69	219.00	224.84	251.37
France (franc)	118.42	119.71	141.64	307.87	311.23	368.22
FRG (mark)	37.18	38.91	46.39	96.66	101.16	120.60
Italy (lira)	25,500	25,208	29,563	66,293	65,543	76,858
Japan (yen)	2,868	2,999	3,763	7,455	7,796	9,782
Netherlands (guilder)	41.91	44.08	52.37	108.96	114.59	136.16
South Africa (rand)	35.15	34.61	29.02	91.38	89.98	75.44
Spain (peseta)	2,363	2,430	2,606	6,144	6,317	6,775
Sweden (krona)	119.83	122.61	134.36	311.54	318.77	349.29
Switzerland (franc)	31.10	32.49	38.92	80.84	84.47	101.19
UK (pound)	11.05	11.31	12.10	28.72	29.39	31.47
US (dollar)	17.10	16.70	14.90	44.46	43.42	38.74

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on April 30, 1986.

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CURRENT MARKET DATA

CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U as UF_6			per kg. U as UF_6		
Country (currency)	**This Month (Apr 30, 1986)**	**Last Month (Mar 31, 1986)**	**12 Months Ago (Apr 30, 1985)**	**This Month (Apr 30, 1986)**	**Last Month (Mar 31, 1986)**	**12 Months Ago (Apr 30, 1985)**
Australia (dollar)	2.57	2.53	2.29	5.66	5.57	5.04
Belgium (comm. franc)	84.03	85.88	93.81	185.26	189.33	206.81
Canada (dollar)	2.62	2.51	2.05	5.78	5.54	4.52
Finland (markka)	9.36	9.32	9.73	20.63	20.55	21.46
France (franc)	13.16	12.90	14.26	29.01	28.45	31.43
FRG (mark)	4.13	4.19	4.67	9.11	9.25	10.30
Italy (lira)	2,833	2,717	2,976	6,246	5,990	6,561
Japan (yen)	318.63	323.22	378.79	702.46	712.57	835.08
Netherlands (guilder)	4.66	4.75	5.27	10.27	10.47	11.62
South Africa (rand)	3.91	3.73	2.92	8.61	8.22	6.44
Spain (peseta)	262.58	261.89	262.33	578.88	577.38	578.34
Sweden (krona)	13.31	13.22	13.53	29.35	29.14	29.82
Switzerland (franc)	3.46	3.50	3.92	7.62	7.72	8.64
UK (pound)	1.23	1.22	1.22	2.71	2.69	2.69
US (dollar)	1.90	1.80	1.50	4.19	3.97	3.31

SWU VALUE AND UF_6 VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	**SWU Value delivery within one year (April 30, 1986)**	**UF_6 Value per kg.U in UF_6 This Month (April 30, 1986)**	**UF_6 Value per kg.U in UF_6 Last Month (March 31, 1986)**
Australia (dollar)	108.11	65.54	67.34
Belgium (comm. franc)	3,538	2,145	2,290
Canada (dollar)	110.31	66.88	67.03
Finland (markka)	394.09	238.92	248.58
France (franc)	554.02	335.87	355.09
FRG (mark)	173.95	105.46	111.84
Italy (lira)	119,296	72,323	72,452
Japan (yen)	13,416	8,133	8,619
Netherlands (guilder)	196.08	118.87	126.68
South Africa (rand)	164.44	99.69	99.48
Spain (peseta)	11,056	6,703	6,984
Sweden (krona)	560.62	339.87	352.42
Switzerland (franc)	145.48	88.20	93.39
UK (pound)	51.68	31.33	32.50
US (dollar)	80.00	48.50	48.00

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on April 30, 1986.

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RECENT TRANSACTIONS[1]

Uranium Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price as Percent of Current Exchange or UF_6 Value	Seller	Buyer	Remarks
3722	1986	101-300	101	R[5]	US Utility	UF_6.
3716	1986	301-600	101	US Producer	European Utility	
3715	1987	601-1,000	101-103	R[5]	US Utility	UF_6.
3714	1986	50-100	100	US Producer	European Utility	
3713	1986	less than 50	99	Fabricator	European Utility	UF_6.
3701	1986	101-300	97	Trader	European Utility	UF_6.

Conversion Services Secondary Market Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U equivalent)	Approximate Price as Percent of Current C.V.	Seller	Buyer	Remarks
3717	1986	101-300	95-100	R[5]	US Utility	
3702	1986	50-100	R[5]	Trader	European Utility	

Enrichment Services Secondary Market Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity[2] (thousands of SWUs)	Approximate Price[3] as Percent of Current SWU Value[4]	Seller	Buyer	SWU Origin	Remarks
3721	1986	less than 50	96-98	R[5]	European Utility	R[5]	
3707	1986	less than 50	101	US Utility	Trader	DOE	
3700	1986	less than 50	100	US Utility	US Utility	DOE	

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[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] If tails assay is unknown or unspecified, Nuexco's calculation of SWU quantity assumes 0.20 w/o tails assay.

[3] Price is not normalized to 0.20% tails assay.

[4] Refers to SWU Value that corresponds to SWUs included in transaction. When prices and SWU values are expressed as discounts (e.g. X dollars less than DOE's USEC base price at time of delivery), the percentage refers to the ratio of the *discounts*, not the ratio of the prices.

[5] The notation *R* means that Nuexco either does not know, or that Nuexco has restricted that information to protect client confidentiality.

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CURRENT MARKET DATA

URANIUM SUPPLY
(April 30, 1986)

	Delivery Period[1] (Thousands of Pounds U_3O_8)		
Nuexco Project Number	**Spot or Near-term[2]**	**Intermediate or Long-term**	**Remarks**
Available for Sale:			
ACTIVE			
2335	400	—	
2740	175	—	
2777*	500	—	
2810*	195	175	UF_6
2813*	70	—	
2826*	160	—	UF_6
2919*	40	—	
2933*	300	300 per year	
3023	750	500	UF_6
2263		400 per year	1987 on
2625	—	500 per year	1987 on
2778	—	220 per year	1987-90
2781	—	100 per year	1988-95
TOTAL	2,590		
INACTIVE			
2336	250	250 per year	1986-94
2389	75	75 per year	1986-90
2703	750	—	
2764	260	—	UF_6
2765	260	—	UF_6
2851*	70	—	
2853	65	—	
2871	50	—	
2297	—	200 per year	1986-89
TOTAL:	1,780		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2728, 2802, 2838.

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URANIUM DEMAND
(April 30, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or long-term	Remarks
Inquiries to Purchase:			
ACTIVE			
2806	200	—	
2858*	750	—	UF_6
2930	250	—	UF_6
2943*	25	—	UF_6
2217	—	1,000 per year	1989-95
2507	—	600	1987-89
2586	—	250 per year	1988-95
2681	—	500 per year	UF_6 or U_3O_8; 1987-88
2738	—	1,000	1989 on
2760	—	750 per year	1987-90
2770	—	500 per year	1988-94
2782	—	900	1988
2821	—	120 per year	1988-93
2850	—	300 per year	1990-95
2870	—	100	1989
2915*	—	25 per year	1990-94
TOTAL:	1,225		
INACTIVE			
2661*	250	250 per year	1986-87
2733	500	500 per year	1987-95
2784	100	—	
2798	70	—	
2845*	400	—	
TOTAL:	1,320		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2548, 2743, 2786, 2808.

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CURRENT MARKET DATA

LOAN SUPPLY AND DEMAND
(April 30, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Within 1 Year	Beyond 1 Year	Remarks
Available for Loan:			
INACTIVE			
1938	2,000	—	UF_6
2036	500	—	
2667	800	—	
2920*	2,000	—	
TOTAL:	5,300		

*New or revised since last month.

[1] Measured from the date of this Report.

Projects removed since last month: 2805.

No inquiries to borrow are reported this month.

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CONVERSION SUPPLY AND DEMAND
(April 30, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U as UF₆) Within 3 Years	Beyond 3 Years	Remarks
Available for Sale:			
ACTIVE			
2717	175	—	
2826B*	100	—	
2849*	550	500	1987-90
TOTAL:	825		
Inquiries to Purchase:			
ACTIVE			
2833	400	—	
2920B*	165	—	
2925*	60	—	
TOTAL:	625		

*New or revised since last month.

[1] Measured from the date of this Report.

Projects removed since last month: 2865, 2874, 2882.

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CURRENT MARKET DATA

SWU SUPPLY AND DEMAND
(April 30, 1986)

	Delivery Period[1] (Thousands of SWUs)		
Nuexco Project Number	Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
2571	—	55	1987
2873	40	—	
2914*	15	—	
2953*	200	—	
TOTAL:	255		
INACTIVE			
2410A	340	—	
TOTAL:	340		
Inquiries to Purchase:			
ACTIVE			
2879*	150	—	
TOTAL:	150		
INACTIVE			
3024*	10	—	
TOTAL:	10		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes SWUs deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2844.

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1986 WORLD URANIUM PRODUCTION FORECAST

Introduction

Nuexco expects world uranium production to increase to 93.0 million pounds U_3O_8 in 1986. This represents a four-percent or approximately 3.4 million pound increase over the 1985 level of 89.6 million pounds. In general, anticipated decreases in production by most African producers should be offset by increases in production in Australia, Canada and the USA. Table 1 compares the 1986 forecast with actual production figures for 1984 and 1985.

Australia and Canada

Nuexco expects Australian production levels to move slightly closer to capacity (10.8 million pounds U_3O_8) than in 1985. However, unresolved water problems and a brief labor dispute at Energy Resources of Australia's (ERA) Ranger operation may hold output to somewhat less than full capacity.

In Canada, a small increase in production is expected at Saskatchewan Mining Development Corporation's Key Lake operation as it approaches its capacity production level of 12 million pounds U_3O_8 per year. Eldorado Resources Ltd. should increase its output as higher grade ores from the Collins Bay "B" deposit replace those of the mined-out Rabbit Lake deposit. No major changes are foreseen for Ontario producers.

Africa

From 1981 through 1985, uranium production decreased steadily in Gabon, Namibia and Niger, dropping from 24.3 million pounds U_3O_8 in 1981 to 19.6 million pounds in 1985. Table 2 gives production figures for those countries during that period. It is likely that the current market conditions for uranium do not provide sufficient incentive for these producers to increase their output. In addition, increasing upward pressure on production costs will continue to constrain the quantities produced.

Table 1

WORLD URANIUM PRODUCTION
(Millions of Pounds U_3O_8)

Country	1984	1985	1986[1]
Australia	10.3	8.5	8.8
Canada	29.0	28.3	29.7
France	8.2	8.0	8.0
Gabon	2.3	2.3	2.2
Namibia	9.6	9.0	8.6
Niger	8.5	8.3	7.9
South Africa	14.9	12.7	12.3
United States	14.9	11.1	14.1
Other[2]	1.7	1.4	1.4
TOTAL	99.4	89.6	93.0

[1] Nuexco forecasts.

[2] Includes Argentina, Belgium, Brazil, Portugal, and Spain.

Following the shutdown of operations at many of South Africa's higher-cost production sites over the past few years, U_3O_8 production probably will stabilize in the 12-13 million pound range for the foreseeable future. Political, labor and economic pressures, however, could reduce these expectations and the recent declines in production may continue.

United States and Other Nations

The expected increase in uranium production in the USA is attributable to a resurgence of conventional production from two major sources.

1. The reopening of the Energy Fuels/Union Carbide White Mesa mill, which will process high-grade ores from Energy Fuels' breccia pipe deposits in northern Arizona. Production from this source could approach 6,000,000 pounds U_3O_8 in 1986, which would make Energy Fuels the largest US producer. A substantial portion of this increase can be attributed to ore stockpiled during 1984 and 1985.

2. The commencement of sustained production from Chevron's Mount Taylor project (see Report 212, April 1986), which could average 1.5 million pounds per year from high-grade ores through the early 1990s.

No major changes are expected for European producers. Forecasts for other nations (including Argentina, Belgium, Brazil, France, Portugal, and Spain) show little change, with the exception of Argentina. The Argentine government's proposed closure of the Marlague operation could reduce the nation's production capacity to about 400,000 pounds U_3O_8 per year, down from 600,000 pounds annually. Overall, Nuexco expects that low uranium prices will continue to exert pressure on the higher-cost producers and that lower-cost producers will gain an increasing share of future production.

Table 2

HISTORICAL URANIUM PRODUCTION
IN CENTRAL AFRICA AND NAMIBIA
(Millions of Pounds U_3O_8)

Country	1981	1982	1983	1984	1985	1986[1]
Gabon	2.7	2.5	2.6	2.3	2.3	2.2
Namibia	10.3	9.8	9.7	9.6	9.0	8.6
Niger	11.3	11.1	8.9	8.5	8.3	7.9
TOTAL	24.3	23.4	21.2	20.4	19.6	18.7

[1] Nuexco forecasts.

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RECENT DEVELOPMENTS

AUSTRALIA

In an unexpected move, Pioneer Concrete Services, Ltd. the parent company of Queensland Mines Ltd. (QML), announced an agreement with North Broken Hill Holdings to acquire the 31-percent share of Energy Resources of Australia (ERA) held by North Broken Hill for about US$164.5 million. Table 3 shows the revised ERA ownership structure, provided the transaction obtains the approval of the shareholders.

The Japanese, German and Swedish shareholders, which together own 25 percent of ERA, receive about 75 percent of the nominal annual output of 6.6 million pounds U_3O_8, and have the right to purchase 75 percent of increased production resulting from any expansion. The price that ERA received from these shareholders/customers was reduced to US$30.09 per pound U_3O_8 effective in 1985. For the purpose of those supply contracts, the price was frozen at the level of the Australian floor price in early 1980. Prior to 1985, prices were fixed at higher levels (as high as US$38.00 per pound U_3O_8) as required by agreements with the lenders that provided the Ranger project financing. It has been reported that for 1985 and later years, delivery prices are related to spot market levels, subject to the Australian floor. Moreover, the buyers earn credits to the extent that spot prices are below the floor price; such credits can be utilized to reduce future delivery prices if, as and when spot prices again exceed the floor price.

Table 3

POTENTIAL OWNERSHIP STRUCTURE OF ERA[1]

Shareholder	**Country**	**Percent Ownership**
PEKO-Wallsend Operations, Ltd.	Australia	32.61[2]
Pioneer Concrete Services, Ltd.	Australia	30.96
Japan Australia Uranium Resources Development Company Ltd.	Japan	10.00
Rheinbraun Australia	FRG	6.25
Urangesellschaft Australia Pty. Ltd.	FRG	4.00
Interuranium Australia	FRG	3.75
Oskarshamnverkets Kraftgrupp AG (OKG)	Sweden	1.00
Public Shareholders		11.43
		100.00

[1] Subject to shareholder approval of North Broken Hill sale.

[2] Includes approximately 0.8 percent purchased by PEKO-Wallsend from public shareholders in April 1986.

ERA also has two supply agreements with Korea Electric Power Company, and others with Synatom, Wisconsin Electric Power Company, American Electric Power Company, Virginia Electric Power Company, and Pennsylvania Power and Light Company. Though not officially announced, agreements are also in place with two other US utilities, and at least two other agreements may be approaching conclusion.

The decision to take a minority equity interest in ERA is a clear indication that Pioneer was convinced that substantial values exist, and if so, the move represents a vote of confidence in the future prospects of both ERA and the Australian uranium industry. However, the actual situation may be more complicated. As in the USA and other nations, Australia's major corporations have become targets of aggressive investors, typically intent on taking control and redeploying assets with a view towards enhancing shareholder values. North Broken Hill's proposed sale of its ERA interest is actually part of an asset divestment program stemming from a desire to remain independent. Pioneer's proposed acquisition of the ERA interest might be similarly motivated. By incurring the substantial debt needed to purchase the ERA shares, Pioneer would make itself a less attractive takeover target.

Some analysts have noted the obvious conflicts of interest:

— Pioneer would own 31 percent of ERA while at the same time owning QML, ERA's direct competitor in Australia.

— Pioneer would have representatives on the Board of Directors of ERA, privy to ERA's private deliberations. There is speculation that by selling QML, Pioneer would avoid the conflict of interest. Moreover, by divesting itself of QML (an important cash generator) Pioneer would make itself even less attractive to unfriendly investors. Finally, if QML was sold to ERA, Pioneer could accomplish those goals *and* retain a partial interest in QML.

JAPAN

In Report 212 (April 1986), Nuexco reported the outcome of annual uranium price negotiations between some Japanese utilities and South Africa's Nuclear Fuels Corporation (NUFCOR). The utilities agreed to pay approximately US$30.50 per pound U_3O_8 for deliveries during 1987, a reduction of about $2.00 from the previous year's negotiated price. Shortly thereafter, Tokyo Electric Power Corporation and six other Japanese utilities also concluded their annual price negotiations for deliveries under long-term supply contracts with Namibia's Rossing Uranium Limited. Rio Tinto Zinc is the project's operator and largest shareholder. For deliveries during 1987, the utilities agreed to pay slightly less than US$32.00 per pound U_3O_8. This represents a reduction of about $1.00 per pound U_3O_8 from the price paid for the previous year's deliveries.

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Reports indicated that the Rossing owners sought a price of approximately $33.00, equal to the 1986 negotiated price. However, the low uranium spot prices prevalent during 1985, combined with decreasing petroleum prices, undoubtedly had a strong impact on the negotiations. In addition, the $2.00 drop in the negotiated price between NUFCOR and some Japanese utilities for 1987 deliveries may have given the utilities a more favorable position in the negotiations with the Rossing representatives.

SOUTH AFRICA

First quarter 1986 uranium production from Chamber of Mines producers totaled 2,983,000 pounds U_3O_8, a four-percent decline from the fourth quarter of 1985 (Table 4). The decline was due chiefly to lower production at Randfontein (a 9-percent drop) and Western Areas (a 13-percent drop) following labor disputes. In addition, production fell 18 percent at Buffelsfontein because of a shortage of underground working face in the Strathmore shaft area. Production remained virtually constant at most of the other operations. Nuexco expects 1986 uranium production in South Africa to total approximately 12.3 million pounds U_3O_8.

UNITED STATES

Ferret Exploration Company of Nebraska announced that it has entered into an agreement to purchase the Wyoming Fuel Company ownership interest in the Crow Butte Joint Venture uranium project near Crawford, Nebraska. The project, formed in 1979, had been owned by Wyoming Fuel Company (50 percent), Ferret Exploration Company (40 percent), and First Exploration Company (10 percent). The transaction will increase Ferret Exploration's interest to 87.5 percent of the joint venture, and First's interest to 12.5 percent. Neither Wyoming Fuel nor its parent company, Kansas-Nebraska (K N) Energy, Inc., has commented publicly regarding the reasons behind the sale of the interest in Crow Butte or the price involved.

Wyoming Fuel acquired a regional lease position of about 64,000 acres in northwestern Nebraska in 1978. The lease position was acquired to explore for sandstone uranium mineralization. Wyoming Fuel and Ferret Exploration formed the joint venture in 1979, and Wyoming Fuel, as project operator, undertook a regional exploration drilling program. The Crow Butte deposit was discovered in the fall of 1980. In 1981, based on 127 holes drilled within the mineralized trend, a news release stated that probable potential reserves exceeded 25 million pounds

Table 4

REPUBLIC OF SOUTH AFRICA
RECENT URANIUM PRODUCTION[1]
(Thousands of Pounds U_3O_8)

Operation	Fourth Quarter 1985	Total 1985	First Quarter 1986
Buffelsfontein	428	1,573	353
Chemwes (Stilfontein)	139	595	137
Driefontein Consolidated	48	191	41
ERGO[2]	95	346	91
Harmony	234	940	231
Hartebeestfontein	240	944	238
JMS[3]	310	1,328	318
Randfontein	371	1,343	339
Vaal Reefs	1,059	4,151	1,082
Western Areas	178	687	155
TOTAL[4]	3,102	12,218	2,983

[1] Excludes Palabora Mining Company, which is not a member of the Chamber of Mines.
[2] ERGO = East Rand Gold and Uranium Co. Ltd.
[3] JMS = Free State Joint Metallurgical Scheme.
[4] Columns may not add due to rounding.

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U_3O_8. First Exploration Company, a subsidiary of Ferret, obtained a ten-percent ownership interest in the venture.

The deposit will be mined using the *in-situ* leach method. In early 1983, the partners filed permit applications with the Nuclear Regulatory Commission (NRC), the Environmental Protection Agency (EPA), and the Nebraska Department of Environmental Control (DEC). All permits were granted by early 1985, enabling the project operators to begin construction on a pilot plant for experimental leaching. The partners had begun marketing both the projected output and equity participation in the project to fund the startup of operations. Such an equity participation arrangement with another organization may be close to conclusion. The pilot plant is almost complete, and officials expect operation to begin in June 1986. The conclusion of the sale of Wyoming Fuel's interest is pending based on NRC and state acceptance of the permit and license transfer from Wyoming Fuel to Ferret Exploration Company of Nebraska, the new operator.

USSR

On or around April 26, an explosion and fire occurred at one of the two 1,000-MWe light-water-cooled, graphite-moderated (RBMK-1000) nuclear units at the Chernobyl Station, leading to a large radioactive release. The station is located 80 miles north of Kiev and includes the two RBMK-1000 units as well as two 1,000-MWe PWRs. The RBMK-1000 consists of a uranium core inside of a graphite bed that moderates the reaction, and a series of zirconium alloy tubes that carry the cooling water through the graphite bed.

As of press time, the causes and details of the nuclear accident at the Chernobyl station are neither complete nor clear. However, based on fragmentary reports, expert opinion and analysis of fallout, it is evident that the accident is orders of magnitude more serious than the 1979 accident at Three Mile Island (TMI) Unit 2. Official and unofficial reports of the extent of damage, number of casualties, remedial actions, and potential long-term effects of the Chernobyl accident have varied widely. Moreover, the Soviet reluctance to report openly and accurately on the matter has resulted in increased speculation, curiosity, and fear. Understandably, this has led to enormous media attention which generally has been negative towards nuclear power.

Even while lacking accurate information about the details of the accident, it is appropriate to comment on some of the likely consequences of this event. Like the 1979 accident at TMI, the Soviet disaster has become a media event, particulary on television. There have been extensive news reports showing weather maps with potential fallout patterns, speculation from nuclear experts and health physicists regarding causes and effects of the accident and briefings from government officials concerning the political consequences. Public attention has been refocused on the dangers of nuclear power with little balancing commentary on its benefits or the significant differences between the Soviet program and those in the rest of the world.

Once again the nuclear industry has been put in a defensive position, as opponents of nuclear power force the industry to explain why such an event could not happen in any other country. Public involvement will result in increased political and regulatory attention, and various groups will compete with one another to offer new solutions, new safety measures, and new regulations. Undoubtedly, new committees will be formed and new studies commissioned as political structures attempt to demonstrate to their constituencies that they are concerned and are responding to the matter.

That response is likely to affect the nuclear industry without regard to the particular facts and circumstances of the Chernobyl accident. Ultimately, the specific technical details of the accident may be of little consequence other than to nuclear industry scientists and engineers. The *perceived* facts that will force action are

— the fact that an accident occurred, and it occurred near a major population center,

— the radioactive release and fallout were substantial, and the fallout has crossed international boundaries, and

— officials in the USSR have chosen to disclose only the slightest details of the accident to the rest of the world.

Within the commercial nuclear power industry, it is likely that nuclear units that have not yet entered commercial operation will be the most vulnerable to the renewed anti-nuclear campaign. These include planned units, units under construction, and completed units in various stages of licensing. Most susceptible are those units nearing commercial operation. Nuexco anticipates that previously established emergency evacuation plans will undergo considerable scrutiny, and many such plans may be judged inadequate as more details about the radiation release at Chernobyl are confirmed. Evacuation plans determined to be inadequate will defer operation dates by at least months, and in some cases years. Abandonment of one or more completed plants is a possibility. Other units at risk include those that are planned but are not yet under construction because of opposition from various sources.

Nuexco estimates that reactors representing more than 20,000 MWe worldwide are likely to experience near-term delays that will affect uranium demand. Included in that figure are reactors representing nearly 5,000 MWe that might be canceled outright. For the uranium market, which was experiencing a slow, gradual recovery from record low price levels, the Chernobyl accident is another factor impeding recovery. Any delays in reactor operations lead to reductions in projected uranium consumption. In

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addition, as carrying charges on unfinished plants increase, utility inventory sales of uranium become more likely. Any plant cancellations or abandonments by utilities having only one reactor planned or under construction would also trigger inventory sales. Uranium buyers are apt to react to this situation by waiting to see if prices weaken. Because the majority of current demand is discretionary in nature, the price recovery that was in progress could be arrested or reversed if buyers defer purchasing decisions. Similarly, long-term buyers might reevaluate the timing of their market entry. Producers will undoubtedly resist lower prices, either in the spot or longer-term markets. The different motivations of inventory sellers, however, could pressure some into liquidating inventories rather than waiting for the next market turn.

The accident is clearly a setback for the nuclear power industry and its suppliers of materials and services, and the following results are likely.

1. There will be some additional reactors delays with the potential for a few cancellations.

2. Some uranium demand will be deferred.

3. Some additional inventory liquidations will take place, but they should be modest compared to those initiated by the TMI accident.

4. The upward price movement of the last twelve months is likely to be interrupted, and price weakening in the near term is possible until the supply-demand balance is realigned.

AMPLIFICATIONS

In the article on World Uranium Resources in Report 211 (March 1986), the section on Australia's resources contained some misleading information.

1. *"Uranium Mining — The Australian Environment,"* by P.J. Bradfield, presented at the AIF Symposium on October 1, 1985, has not been recognized as the *official* source of Australian resource data, as Nuexco indicated. The official source of such data is Australia's Bureau of Mineral Resources (BMR). However, BMR's published data is aggregated, so it does not separate individual deposits into cost categories. Consequently, the classification of the Olympic Dam resources included in the various cost categories have no official basis.

2. As stated by the project's partners, the probable reserve figure for Olympic Dam is 397,000 tons U_3O_8. Moreover, uranium and copper are to be co-products of the project; neither will be secondary to the other.

3. Finally, there is no basis for believing that Australia's resources in the less than $30 per pound U_3O_8 category are any more suspect than those of other countries. However, factors other than cost may exert a significant influence over the exploitation of those resources.

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UPDATE

SAFEGUARDS AND THE INTERNATIONAL URANIUM MARKET

Introduction

The Nuclear Nonproliferation Treaty (NPT) and the system of nuclear material accountability set up by the International Atomic Energy Agency (IAEA) comprise the basic groundwork for international cooperation in the nuclear industry. Stemming from a desire to reduce the proliferation of nuclear weapons and to promote the peaceful uses of atomic energy, various nations cooperated in bringing about an organized way to reach these and other goals. This update focuses on the current state of the Nuclear Nonproliferation Treaty, IAEA safeguards, and their effect on uranium commerce worldwide.

History of International Nuclear Cooperation

Under the Atoms for Peace program initiated by the USA in the early 1950s, the first policies of international cooperation in the peaceful uses of atomic energy were established. The US Congress, through the Atomic Energy Act of 1954, authorized the export of US uranium, other nuclear material, and nuclear equipment and technology, provided that the USA was able to establish strict safeguards to insure that there was no diversion of nuclear material from peaceful to military uses. The formation of the IAEA by international agreement led, in the early 1960s, to a program of nuclear material safeguards inspections which would be made available to member nations upon request. Soon thereafter the USA, which had adopted a series of bilateral agreements with other nations, shifted its safeguards responsibilities to the IAEA.

The Nonproliferation Treaty

The NPT was opened for signature by resolution of the United Nations in July 1968 and went into effect for members in March 1970, after ratification by forty non-nuclear weapon States. The basic provisions of the NPT are contained in Articles I and II. Article I applies to the nuclear weapon States, i.e. a nation which had exploded a nuclear weapon before January 1, 1967. The USA, the United Kingdom, USSR, France and the People's Republic of China are nuclear weapon States. In part, Article I states as follows:

> Each nuclear-weapon State party to the Treaty undertakes not to transfer to any recipient whatsoever nuclear weapons or other nuclear explosive devices...and not in any way to assist, encourage, or induce any non-nuclear weapon State to manufacture or otherwise acquire nuclear weapons or other nuclear explosive devices...

Article II applies to non-nuclear weapon States. These nations agree not to receive explosive nuclear devices from any transferor whatsoever or to manufacture explosive nuclear devices. Article III underscores the inherent discrimination between nuclear weapon States and non-nuclear weapon States by requiring that non-weapon States be subject to on-site inspection for policing NPT terms. Nuclear weapon States are not subject to the inspections. Four of the five nuclear weapon States, however, have been willing to open their commercial nuclear facilities to on-site IAEA inspection, though they are not required to do so under the NPT. Non-nuclear weapons States that have signed the NPT are also required to execute an agreement with the IAEA to provide the safeguards specified under the treaty. The entire civilian nuclear program of those nations is required to be safeguarded by the IAEA. This requirement includes the safeguarding of facilities for *source material* (natural uranium), although in practice, the IAEA focuses on enriched uranium and plutonium.

The NPT also contains a provision which affects nations that are not parties to the Treaty. NPT members are not permitted to transfer nuclear material, including natural uranium, to non-nuclear weapon States unless that material is subject to IAEA inspection in the recipient State, whether or not the recipent State is a party to the NPT. In other words, if any party sold uranium to a non-member of the NPT, that uranium would have to be safeguarded by the IAEA during the entire time the uranium was retained in the recipient State, in whatever form it was used. Thus, since much of the world's uranium is produced by NPT members, the NPT has considerable influence on uranium commerce, even for those nations which have not become members. Any nation unwilling to comply with IAEA safeguards should be unable to purchase uranium from an NPT member.

These relationships can be illustrated by using some specific examples of international uranium commerce.

1. Gabon, an NPT member, sells natural uranium to the Federal Republic of Germany (FRG). The FRG is a non-nuclear weapon State and a party to the NPT. Therefore, the uranium will automatically be safeguarded while it is in the FRG, since the FRG's entire nuclear program is safeguarded under NPT obligations.

2. Gabon sells to Spain, which is not an NPT member. Spain's program is not subject to IAEA safeguards under the NPT. However, because Gabon is an NPT member, it is not permitted, under the terms of the NPT, to transfer uranium to Spain unless Spain agrees to put *that uranium* under IAEA safeguards. The safeguards required of Spain extend only to that uranium transferred from the NPT member (Gabon), and not to other aspects of Spain's nuclear program.

3. Gabon sells to France, a nuclear weapon State not party to the NPT. Even though Gabon is an NPT member, it may still sell to France without requiring that France submit that uranium to IAEA safeguards. France's status as a nuclear weapons State makes it exempt from provisions which would require Gabon to

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insist that any exported uranium be subject to IAEA inspection.

4. South Africa, not a member of the NPT, sells to Japan, which is a member. The uranium will be safeguarded because Japan's obligations under the Treaty require that its entire civilian nuclear program be safeguarded.

5. Argentina sells to Spain. Because neither nation is a party to the NPT, the uranium would not be safeguarded by the IAEA, unless the internal policy of either nation required it.

6. The USA sells to France. Under the NPT, this uranium would not have to be safeguarded, since France is a nuclear weapon State. However, the USA (as well as some other supplier nations) has internal laws requiring that uranium sold abroad be subject to IAEA safeguards or similar controls while it is in the recipient nation, whether or not that nation is a nuclear weapon State.

7. The USA sells to Spain. Spain is a non-nuclear weapons State, so US obligations under the NPT require that the uranium be safeguarded. In addition, US law requires such safeguarding of exported uranium.

Current Status of the NPT

The IAEA Annual Report for 1984 lists 129 parties to the Nonproliferation Treaty as of October 1985. Four additional nations have signed but not yet ratified the NPT. Three of the five nuclear-weapon States have signed the NPT (USA, United Kingdom, USSR); France and the People's Republic of China are the nuclear weapon States that have not signed the NPT. A State becomes party to the NPT on deposit of an instrument of ratification, accession, or succession from its national government to the NPT depository nations. The UK, USA and USSR are depository governments. Under the terms of the NPT, each non-nuclear weapon State signatory is also required to execute an agreement with the IAEA. This agreement provides the framework for implementation of the safeguards specified under the Treaty. By the end of 1984, there were a total of 163 safeguards agreements in force with 95 States.

Nations which have not signed the NPT can enter into safeguards agreements with the IAEA which cover all or part of the countries' nuclear activities. By placing their nuclear activities under IAEA inspection, these nations are allowed access to nuclear materials. NPT members can transfer nuclear material, including natural uranium to non-nuclear weapon States *only if* that material would be subject to IAEA inspection in the recipient State. Spain, Brazil, and Argentina are examples of non-nuclear weapon States which have IAEA safeguards agreements in place but have not signed the NPT.

A notable event that took place at the IAEA 29th General Conference in September 1985 was the statement by the Conference delegate from the People's Republic of China that the Chinese government has decided to voluntarily offer to place some of its civilian nuclear installations under IAEA safeguards "at an appropriate time." At present, four of the five nuclear weapons States — France, the United Kingdom, the USA and the USSR — have this type of voluntary-offer agreement in place with the IAEA.

Table 5 provides a summary of the NPT status and IAEA agreements status of most nations that participate in nuclear fuel transactions. Nuexco will update the status of the various bilateral safeguards in force worldwide in a later report.

Table 5

NPT AND IAEA SAFEGUARDS STATUS WORLDWIDE[1]

Country	NPT Member as of	Safeguards Agreement in Force with the IAEA as of
Argentina		Mar 1970[2]
Australia	Jan 1973	Jul 1974
Austria	Jun 1969	Jul 1972
Belgium	May 1975	Feb 1977
Brazil		Oct 1968[3]
Bulgaria	Sep 1969	Feb 1972
Canada	Jan 1969	Feb 1972
China (People's Republic)		
Czechoslovakia	Jul 1969	Mar 1972
Egypt	Feb 1981	Jun 1982
Finland	Feb 1969	Feb 1972
France		Sep 1981[4]
Gabon	Feb 1974	Dec 1979
German Democratic Republic	Oct 1969	Mar 1972
Germany (Federal Republic)	May 1975	May 1975
Hungary	May 1969	Mar 1972
India		Nov 1977[2]
Iran	Feb 1970	May 1974
Iraq	Oct 1969	Feb 1972
Israel		see note[3]
Italy	May 1975	Feb 1977
Japan	Jun 1976	Dec 1977
Korea (Republic of)	Apr 1975	Nov 1975
Mexico	Jan 1969	Sep 1973
Netherlands	May 1975	Feb 1977
Niger		
Pakistan		Mar 1977[2]
Philippines	Oct 1972	Oct 1974
Poland	Jun 1969	Oct 1972
Portugal	Dec 1977	Jun 1979
Romania	Feb 1970	Oct 1972
South Africa/Namibia		see note[3]
Spain		Nov 1974[2]
Sweden	Jan 1970	Apr 1975
Switzerland	Mar 1977	Sep 1978
Taiwan	Jan 1970	see note[5]
Turkey	Apr 1980	Sep 1981
Union of Soviet Socialist Republics	Mar 1970	
United Kingdom	Nov 1968	Aug 1978[4]
United States	Mar 1970	Dec 1980[4]
Yugoslavia	Mar 1970	Dec 1973

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[1] Table only includes nations that are likely to buy or sell uranium in the near future. The five nuclear weapon States are listed in italics. Status as of December 31, 1984.

[2] The agreements provide for safeguards other than those in connection with the NPT; i.e., project agreements or unilateral submissions.

[3] Some facilities or material under IAEA safeguards.

[4] Agreements concluded with nuclear weapon States on the basis of voluntary offers.

[5] The IAEA applies safeguards under two agreements to the nuclear facilities in Taiwan. The agreements are implemented by the IAEA on a non-governmental basis because of a 1971 ruling that the People's Republic of China is the only government which has the right to represent China in the IAEA.

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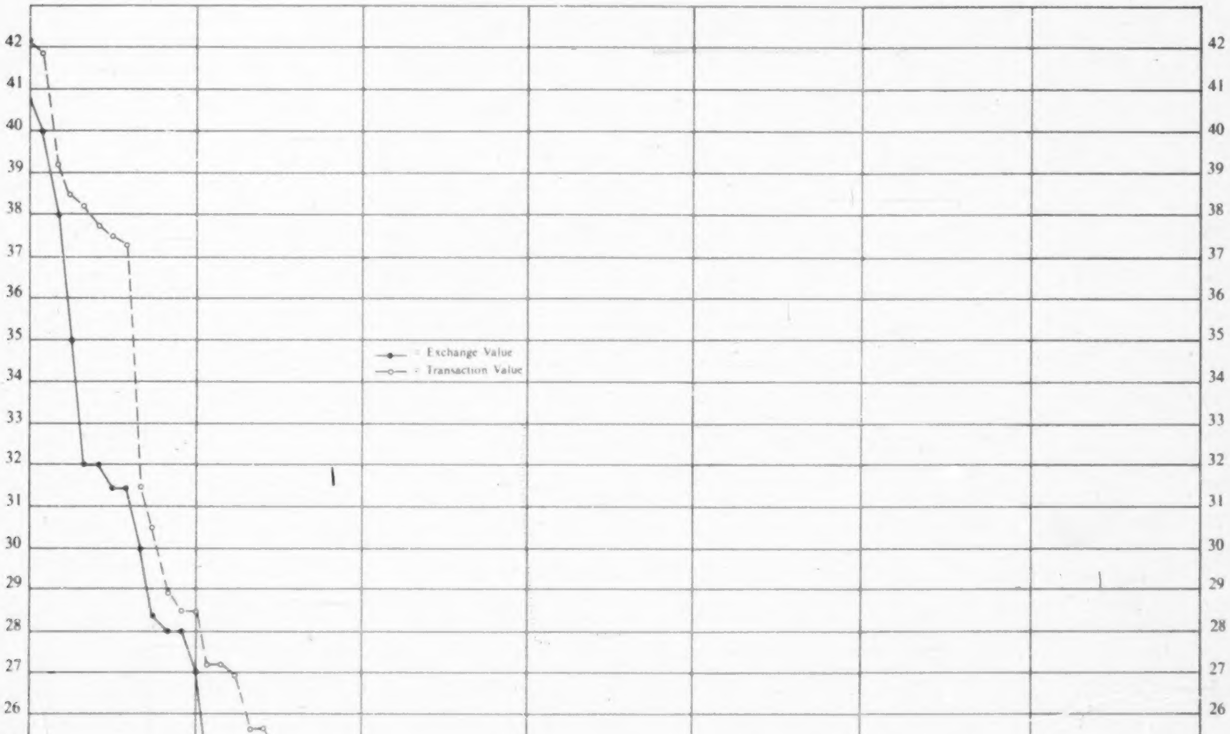
HISTORICAL MARKET DATA

EXCHANGE AND TRANSACTION VALUES
SINCE JANUARY 1980

Determined as of the last day of the month indicated



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HISTORICAL MARKET DATA

HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	32.50	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	**17.25**								

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	**17.10**								

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U in UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.80	**1.90**								

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AUSTRALIA

	Price Index of Materials Used in Manufacturing Industry — All Groups[1] (1984 = 100)	Award Rates of Pay Indexes Australia — Adult Males In Mining Wage Earners, Weekly Rates[2] (1976 = 100)
1975 Avg.	150.4	132.6
1976 Avg.	168.4	160.9
1977 Avg.	192.0	179.0
1978 Avg.[3][4]	198.5	190.0
1979 Avg.	248.8	127.9
1980 Avg.	321.8	140.8
1981 Avg.	355.3	154.1
1982 Avg.[5]	368.6	174.9
1983 Avg.	401.6	181.8
Jan 1984	94.6	188.5
Feb 1984	95.4	188.4
Mar 1984	95.7	188.2
Apr 1984	95.8	196.1
May 1984	95.7	197.3R
Jun 1984	95.9	197.7R
Jul 1984	96.7	197.7R
Aug 1984	97.9	197.7R
Sep 1984	97.6	197.7R
Oct 1984	96.8	197.8R
Nov 1984	96.4	197.8R
Dec 1984	96.2	197.8R
FY84 Avg.[6]	95.3	—
FY85 Avg.[6]	100.0	—
Jan 1985	97.0	197.8R
Feb 1985	98.6	197.8R
Mar 1985	102.1	197.8R
Apr 1985	104.4	202.8R
May 1985	107.6	202.8R
Jun 1985	108.7	202.8R
Jul 1985	111.0	202.8R
Aug 1985	110.5	202.8R
Sep 1985	108.9	202.8R
Oct 1985	109.6	202.8R
Nov 1985	109.6	210.2R
Dec 1985	110.2	210.3R
Jan 1986	109.8	210.3R
Feb 1986	—	210.3
Mar 1986	—	210.3

P = Preliminary R = Revised since last month

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[1] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0). The basis of this index was revised to 1984 = 100. The previous index was 1969 = 100.

[2] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

[3] Monthly data for 1970-78 appear on pages 4.7 and 4.8 of Report 138.

[4] Annual averages prior to 1979 reflect index base no longer in use. ©NUEXCO 1986

[5] Monthly data for 1979-82 appear on page 35 of Report 184.

[6] Annual averages are for financial year ending June 30.

GOVERNMENT STATISTICS

CANADA

		Wage-earner Data: Average Hourly Earnings (C$)[2]					
	Industry Selling Price Index: All Commodities[1] (1981 = 100)	**Uranium Mines (SIC 057)**	**Metal Mines (SIC 051-059)**	**Mines, Quarries and Oil Wells[3] (SIC 051-099)**	**Primary Non-ferrous Metal Industries[4] (SIC 296)**	**(SIC 298)**	**Chemicals and Chemical Products[5] (SIC 372-379)**
1979 Avg.[6]	217.9	—	9.60	9.66	—	—	7.67
1980 Avg.	247.2	—	10.58	10.80	—	—	8.50
1981 Avg.	288.7	—	12.02	12.23	—	—	9.53
1982 Avg.[7]	288.8	—	13.74	13.92	—	—	10.63
1983 Avg.	298.8	—	—	14.30	—	—	11.17
Jan 1984	305.4	17.74	15.27	14.74	11.91	10.84	11.69
Feb 1984	306.6	17.90	15.59	14.90	12.04	10.82	11.51
Mar 1984	308.7	18.05	15.52	14.82	12.14	10.84	11.58
Apr 1984	310.5	18.06	15.83	15.10	11.96	10.34	11.63
May 1984	310.6	18.48	15.64	15.06	12.11	10.16	11.65
Jun 1984	311.0	18.08	15.48	14.80	12.38	10.40	11.66
Jul 1984	312.9	17.81	15.72	14.92	12.53	10.18	11.82
Aug 1984	312.7	17.24	15.36	14.92	12.44	10.34	11.78
Sep 1984	312.3	17.68	15.96	15.34	12.51	10.52	11.90
Oct 1984	312.3	17.64	16.15	15.26	12.69	10.56	11.96
Nov 1984	313.6	18.04	16.13	15.43	12.47	10.51	11.96
Dec 1984	314.2	17.95	16.39	15.60	12.16	10.40	11.99
1984 Avg.	310.9	17.88	—	15.07	12.28	10.49	11.76
Jan 1985	117.5	18.05	16.13	15.60	12.32	10.80	12.04
Feb 1985	117.7	18.78	16.41	15.68	12.52	11.05	12.06
Mar 1985	118.4	18.24	16.21	15.57	12.44	10.97	12.02
Apr 1985	118.3	18.63	16.44	15.80	12.81	11.23	12.04
May 1985	118.6	19.41	16.51	15.63	12.76	11.25	12.15
Jun 1985	118.6	18.49	16.20	15.49	12.89	11.14	12.14
Jul 1985	118.6	18.14	16.27	15.41	12.96	11.17	12.13
Aug 1985	118.4	17.07	16.03	15.30	12.97	11.31	12.19
Sep 1985	118.6	18.53	16.55	15.72	12.95	11.39	12.26
Oct 1985	118.9	18.74	16.51	15.70	13.14	11.53	12.33
Nov 1985	119.2	19.05	16.66	15.88	12.76	11.32	12.49
Dec 1985	119.9	19.07	16.57	16.01	12.51	11.09	12.59
Jan 1986	120.7	18.15R	16.27R	15.86R	13.02R	11.59R	12.50R
Feb 1986	120.5	19.64P	16.63P	15.98P	13.28P	11.39P	12.52P

P = Preliminary R = Revised since last month

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[1] Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Index prior to 1985, 1971 = 100.

[2] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours" (Catalogue 72-002).

[3] Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

[4] Beginning with the April 1983 figure, Primary Metal Industries, non-ferrous is split into SIC 296 and SIC 298.

[5] Chemical and Chemical Products prior to April 1983 was SIC 370-379. The new series is from a new survey which includes all companies and is based on a 1970 classification. The old survey only included companies of 20 employees or more.

[6] Monthly ISPI for 1977 and 1978 appear on page 4.10 of Report 138, and monthly wage-earner data for 1973-78 appear on page 4.11 of Report 138.

[7] Monthly data for 1979-1982 appear on page 37 of Report 184. On that page, the wage earner index entitled "Metal Mining, Including Milling (SIC 050-099)" should read "Total Mining (SIC 051-099)."

[8] Beginning with the April 1983 figure, Wage Earner Data are based on a census of all companies employing 200 or more wage earners, *plus* a random survey of companies employing fewer than 200 wage earners. Prior to April 1983 only companies employing 200 or more wage earners are included in the Wage Earner Data.

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REPUBLIC OF SOUTH AFRICA

		Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1]	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100)[2]	Consumer Price Index[3] (1980 = 100)[4]	Producer Price Index All Groups[5] (1980 = 100)	Total Employment in Mining and Quarrying (Code 35)[6]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[6]
1975	Avg.	16.71	—	157.2	100.0	639,473	1,003,617
1976	Avg.	19.30	—	174.7	115.1	671,240	1,212,983
1977	Avg.	23.87	—	194.4	130.0	712,006	1,420,670
1978	Avg.	27.14	—	137.2	142.7	664,571	1,537,169
1979	Avg.[7]	30.18	—	155.3	164.5	692,209	1,830,632
1980	Avg.[8]	35.53	—	176.7	192.1	714,379	2,279,615
1981	Avg.	41.89	—	206.5	218.3	728,506	2,820,505
1982	Avg.[9]	47.25	104.2	233.5	248.7	707,552	3,246,071
1983	Avg.	51.87	115.0	262.2	274.8	696,579	3,644,772
Jan	1984	—	—	274.7	283.3	689,807	326,619
Feb	1984	—	—	278.4	286.5	702,553	335,906
Mar	1984	55.30	123.1	281.9	288.0	715,628	342,332
Apr	1984	—	—	286.1	290.2	712,963	327,550
May	1984	—	—	288.3	292.6	710,040	327,937
Jun	1984	56.95	126.2	291.2	295.3	717,009	347,121
Jul	1984	—	—	295.1	296.0	717,121	369,964
Aug	1984	—	—	297.0	300.8	721,905	361,357
Sep	1984	60.64	133.2	299.9	304.1	721,470	359,218
Oct	1984	—	—	303.7	308.7	717,865	363,755
Nov	1984	—	—	307.4	312.8	717,396	369,771
Dec	1984	62.92	138.6	309.4	315.9	701,198	365,234
Jan	1985	—	—	177.1	166.6	711,366	376,777
Feb	1985	—	—	182.8	171.3	727,932	361,823
Mar	1985	64.48	142.4	183.6	173.0	708,809	371,380
Apr	1985	—	—	187.4	174.0	724,187	369,005
May	1985	—	—	189.5	177.7	708,085	373,478
Jun	1985	67.42	148.9	191.9	179.2	724,587	395,543
Jul	1985	—	—	193.6	180.7	738,228	419,106
Aug	1985	—	—	195.6	183.2	734,121	416,777
Sep	1985	70.47	155.3	197.8	184.8	732,836	419,883
Oct	1985	—	—	200.8	188.1	720,071	401,448
Nov	1985	—	—	203.4	196.0	750,049	432,996
Dec	1985	72.43	160.1	207.4	199.4	741,372R	425,261
Jan	1986	—	—	213.8	203.6	—	—
Feb	1986	—	—	215.8	206.9R	—	—
Mar	1986	75.76	167.8	218.3	—	—	—

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[1] Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly.

[2] Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

[3] Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."

[4] The basis for calculation prior to January 1985, 1975 = 100. For annual averages prior to 1978, April 1970 = 100.

[5] Previously known as the Wholesale Price Index, now the Producer Price Index. The computation remains the same. The basis for calculation prior to January 1985, 1975 = 100.

[6] Bulletin of Statistics, Department of Statistics, Pretoria.

[7] Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 4.9 of Report 140.

[8] Monthly data for Codes 35 and 40, 1977-1980, appear on page 28 of Report 157.

[9] Monthly data for 1979-82 appear on page 39 of Report 184.

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GOVERNMENT STATISTICS

UNITED STATES

	Producer Price Index[1]		Consumer Price Index[2] (1967 = 100)	GNP Implicit Price Deflator[3,4] (1982 = 100)	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[5]			
	Industrial Commodities (1967 = 100)	All Commodities (1967 = 100)			Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980 Avg.[6]	274.8	268.8	246.8	178.64	10.26	10.63	8.30	6.94
1981 Avg.	304.1	293.4	272.4	195.51	11.55	11.98	9.12	7.62
1982 Avg.[7]	312.3	299.3	289.1	207.15	12.33	12.94	9.96	8.21
1983 Avg.	315.8	303.1	298.4	215.63	12.57	13.43	10.59	8.65
1984 Avg.	322.6	310.3	311.1	108.1	13.05	13.43	11.08	9.04
Jan 1985	322.9	309.5	316.1	—	13.29	13.70	11.39	9.33
Feb 1985	322.5	309.2	317.4	—	13.30	13.73	11.39	9.33
Mar 1985	322.6	308.7	318.8	110.4	13.29	13.95	11.37	9.39
Apr 1985	323.8	309.3	320.1	—	13.43	13.62	11.48	9.40
May 1985	325.3	309.8	321.3	—	13.24	13.59	11.46	9.39
Jun 1985	324.8	309.2	322.3	111.3	13.23	13.66	11.52	9.46
Jul 1985	324.4	309.0	322.8	—	13.45	13.82	11.60	9.47
Aug 1985	323.7	307.3	323.5	—	13.55	13.69	11.62	9.50
Sep 1985	322.3	305.5	324.5	112.1	13.44	13.66	11.67	9.55
Oct 1985	324.2	307.9	325.5	—	13.49	13.64	11.72	9.56
Nov 1985	324.7R	309.5R	326.6	—	13.49	13.95	11.82	9.61
Dec 1985	325.2	310.2	327.4	113.0	13.43	13.78	11.87	9.68
Jan 1986	324.0	309.0	328.4	—	13.40R	13.67R	11.87R	9.61R
Feb 1986	319.4	304.7	327.5	—	13.43P	13.80P	11.82P	9.59P
Mar 1986	314.0	300.3	326.0	113.7P	—	—	11.79P	9.63P
Apr 1986	—	—	—	—	—	—	—	—

P = Preliminary R = Revised since last month

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[1] US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

[2] US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items.

[3] US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

[4] The basis for calculation of this index was revised to 1982 = 100. 1984 and 1985 figures have been adjusted to that basis. The basis for calculation prior to 1984, 1972 = 100.

[5] US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for 1977-1978 are adjusted to the March 1979 benchmark. Data for January 1979 and beyond are adjusted to the March 1980 benchmark.

[6] Monthly data 1970-1978 for Producer Price Index-Industrial Commodities, Consumer Price Index, and Employment and Earnings SIC codes 10, 333, and 28, and quarterly data for GNP Implicit Price Deflator appear on pages 4.6-4.8 of Report 139.
Monthly data 1977-1978 for Employment and Earnings SIC Codes 10, 333, and 28 appear on page 33 of Report 147.
Monthly data 1970-1978 for Employment and Earnings SIC Code 36 appear on page 23 of Report 154.
Monthly data 1977-1980 for Producer Price Index-All Commodities, appear on page 21 of Nuexco Report 158.

[7] Monthly data 1979-1982 for all listed indices appear on page 41 of Report 184.

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NUEXCO

REPRESENTATIVES AND CONSULTANTS

AUSTRALIA

Peter Stork
Oratom Consulting
5 Gould Ave.
St. Ives
NSW 2075, Australia
Telephone: (61-2) 449-6783
Telex: AA123976 (COMTLX)

JAPAN

Kazy Yokota
Japan Tech Services
Ohkura Building (3F)
1-4-10 Shiba Daimon
Minato-ku, Tokyo, Japan
Telephone: (81-3) 431-6031, 6025
Telecopy: (81-3) 434-6674
Telex: 242-5060 (JATECH J)

SOUTH AFRICA

Chris I. Von Christierson
Southern Prospecting (Pty) Limited
P.O. Box 61409
Marshalltown 2107
Republic of South Africa
Street Address:
10th Floor
Eagle Star House
70 Fox Street
Johannesburg 2001
Telephone: (27-11) 838-1868
(27-11) 834-4211
Telecopy: (27-11) 834-3148
Telex: 4-89878 SA

TAIWAN

Edward Bee
Bee & Liang Company, Ltd.
14 FL Universal Business Center
NO. 663, Tun Hwa South Road
P.O. Box 1396
Taipei, Taiwan R.O.C.
Telephone: (886-2) 704-9630
TWX: 785-11570 (BEELIANG)

UNITED STATES

Harold C. Lindberg
83-A Hardee Lane
Whispering Pines, N.C. 28327
Telephone: (919) 949-3622

M. Jerry Reaves
Suite 500
Seven Piedmont Center
Atlanta, Georgia 30305
Telephone: (404) 262-7375

Ralph O. Smith
141 Braemar Drive
Cheshire, Connecticut 06410
Telephone: (203) 272-6246

SPECIAL CONSULTANTS

George J. Stathakis
International Investment Banking

James C. C. Stewart
U.K. Nuclear Industry

Claus C. Thiesen
Japan Nuclear Industry

W. Bryan Webster
International Business Development

J. Robert Wolcott
International Business Development

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NUEXCO REPORT 213 FIGURES OF THE MONTH (April 30, 1986)	This Month (Report 213)	Last Month (Report 212)	12 Months Ago (Report 201)
Exchange Value[1]	17.25	17.25	14.25
Transaction Value[1]	17.10	16.70	14.90
UF_6 Value[2]	48.50	48.00	40.50
Loan Rate[3]	5%	5%	5%
Conversion Value[4]	1.90	1.80	1.50
Near-Term Uranium Supply[5]	2.6	2.5	2.7
Near-Term Uranium Demand[6]	1.2	1.0	1.4
Near-Term Supply-Demand Ratio	2.1	2.7	2.0
Recent Uranium Sales:			
Number of Transactions[7]	6	5	5
Quantity of Material[8]	1.4	0.5	1.7
Nuexco SWU Value:[9]			
at 0.3 tails assay and delivery within one year	80	80	—
USDOE SWU Prices:			
USEC	125.00[10]	125.00[10]	135.00
AFC	153.00[11]	153.00[11]	153.00[11]
Requirements	157.00[11]	157.00[11]	157.00[11]
Market Value of Enriched UF_6[12,13]:			
2.5 w/o U_{235}	467	466	458
3.0 w/o U_{235}	598	596	592
3.5 w/o U_{235}	731	729	728
4.0 w/o U_{235}	866	864	866

---

[1] US $ per pound U_3O_8 equivalent.

[2] US $ per kilogram U as UF_6.

[3] Per annum.

[4] US $ per pound U as UF_6.

[5] Active inquiries to sell, for delivery within 12 months after contract signing (millions of pounds U_3O_8).

[6] Active inquiries to purchase, for delivery within 12 months after contract signing (millions of pounds U_3O_8).

[7] Uranium sales only; does not include loans, conversion, or SWU transactions.

[8] Millions of pounds U_3O_8, equivalent.

[9] US $ per SWU.

[10] Effective 10/1/85.

[11] Effective 10/1/84.

[12] Calculated using the Nuexco Exchange Value, Conversion Value, and 0.30 percent tails assay. From 4/30/85 to 11/30/85, calculations used in the Nuexco SWU Value for DOE origin and delivery by the end of FY86. As of 12/31/85, calculations use the SWU Value for delivery within one year.

[13] US $ per KgU as UF_6, rounded to the nearest $.

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EXECUTIVE SUMMARY
REPORT 213
(All data as of April 30, 1986)

Exchange Value **$17.25, unchanged**	The **Exchange Value** is **$17.25** per pound U_3O_8, unchanged since last month.
UF_6 Value **$48.50, up $0.50**	The **UF_6 Value** is **$48.50** per kilogram U as UF_6, up $0.50 since last month.
Transactions	Six recent natural uranium sales are reported, involving approximately 1.4 million pounds equivalent U_3O_8. Five of the sales involved spot or near-term delivery and five met the conditions for inclusion in the Transaction Value. Four transactions involved natural UF_6.
Supply-Demand Ratio **fell to 2.1:1**	Active spot and near-term **uranium supply** amounts to **2.6 million** pounds U_3O_8 equivalent, up 65 thousand pounds since last month. Active spot and near-term **uranium demand** totals **1.2 million** pounds, up 275 thousand pounds. The spot and near-term **supply-demand ratio** fell to **2.1:1.**
Transaction Value **$17.10, up $0.40**	The **Transaction Value** is **$17.10** per pound U_3O_8, up $0.40 since last month. The calculation includes 19 transactions involving a total of 2.3 million pounds U_3O_8 and equivalent UF_6, and covers a period of 5 months.
Loan Rate **unchanged at 5%**	The **Loan Rate** is **5 percent** per annum, unchanged.
Conversion Value **$1.90, up $0.10**	The **Conversion Value** is **$1.90** per pound U as UF_6, up $0.10 since last month. Active secondary market supply for conversion services for delivery within three years totals 825 thousand pounds U as UF_6. Active demand totals 625 thousand pounds U as UF_6. Two secondary market conversion transactions are reported.
SWU Value for **delivery within** **one year: $80**	The **SWU Value** at .3 tails and for delivery within one year is **$80** per SWU, unchanged since last month. Three secondary market SWU transactions are reported, involving less than 100 thousand SWUs.
	* * *
Analysis and Commentary	Nuexco's forecast of world uranium production in 1986 indicates that approximately 93 million pounds U_3O_8 will be produced. Production increases are expected in Canada, Australia, and especially the USA. Production throughout Central and Southern Africa will probably decrease slightly.
Australia	Pioneer Concrete Services, Ltd., the parent company of Queensland Mines Ltd., has announced an agreement by which it will acquire the 31-percent share of Energy Resources of Australia currently held by North Broken Hill Holdings. If the transaction is approved by shareholders, Pioneer will own significant interests in both of Australia's active uranium production operations.
Japan	Tokyo Electric Power Company and six other Japanese utilities concluded annual price negotiations for deliveries under long-term uranium supply contracts with Namibia's Rossing Uranium Limited. The utilities agreed to pay slightly less than US$32.00 per pound U_3O_8 for deliveries beginning in 1987. The negotiated price represents a reduction of about $1.00 from the price paid for 1986 deliveries.
South Africa	First quarter uranium production from Chamber of Mines producers totaled slightly less than three million pounds U_3O_8, as output remained almost constant at most of the operations.
Soviet Union	A major accident at the Chernobyl nuclear power plant, a four-unit, 4,000-MWe station near Kiev, has rekindled the debate over the safety of nuclear power. The psychological effects alone of such a disaster are likely to impact nuclear power programs and the uranium market worldwide.
United States	Ferret Exploration Company of Nebraska announced that it has entered into an agreement to purchase the Wyoming Fuel Company ownership interest in the Crow Butte Joint Venture. The sale is contingent upon the transfer of licenses to Ferret, the new project operator.
Update	Almost 130 nations are now parties to the Treaty on the Nonproliferation of Nuclear Weapons (NPT). This update reviews the status of the NPT and nuclear safeguards system set up by the International Atomic Energy Agency for international cooperation in the nuclear industry, as well as its relationship to worldwide uranium commerce.

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JUNE 1986 NUMBER 214

MONTHLY REPORT

ON THE NUCLEAR FUEL MARKET

NUEXCO

HEADQUARTERS

Three Park Central
1515 Arapahoe Street
Suite 1045
Denver, Colorado 80202
Telephone: (303) 893-4015
Telecopy: (303) 825-4821
Telex: 450202 (NUEXCO DVR)

Chairman of the Board of Partners
Oren L. Benton

Vice Chairman of the Board of Partners
Samuel R. Freeman

EASTERN UNITED STATES

100 Prospect Street
Century Plaza South
Stamford, Connecticut 06901
Telephone: (203) 323-1999
Telecopy: (203) 325-1483
Telex: 4750124 (NUEXCO C)

Managing Broker
Earl E. Hoellen, Jr.

WESTERN UNITED STATES

Building 3, Suite 290
3000 Sand Hill Road
Menlo Park, California 94025
Telephone: (415) 854-1510
Telecopy: (415) 854-2115
Telex: 470674 (NUEXCO UI)

Managing Broker
George White, Jr.

EUROPE

13 chemin du Levant
01210 Ferney-Voltaire
France
Telephone: (33-50) 428035
Telecopy: (33-50) 428526
Telex: 385288 (NUEXCO F)

Managing Broker
James E. Vaughan

REGIONAL MANAGING BROKERS

AFRICA
James E. Vaughan

AUSTRALIA
George White, Jr.

CANADA
Wayne D. Fowler
(303) 893-4015

FAR EAST
Christian C. Guitton
(415) 854-1510

MEXICO AND SOUTH AMERICA
Earl E. Hoellen, Jr.

(See inside back cover for list of Representatives and Consultants)

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MONTHLY REPORT ON THE NUCLEAR FUEL MARKET

June 1986 No. 214

GEORGE WHITE, JR., *EDITOR* CLARK M. BEYER, *ASSOCIATE EDITOR*

PRICING

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NATURAL URANIUM AND SECONDARY MARKET CONVERSION

(All data as of May 31, 1986)

The **Exchange Value** is **$17.00** per pound U_3O_8, down $0.25 since last month. **Active supply** of natural uranium (concentrates and UF_6) for spot or near-term delivery totals **4,215,000** pounds U_3O_8 equivalent, up 1.6 million pounds since last month. The corresponding figure for **active demand** is **975,000** pounds, down 250 thousand pounds. The spot and near-term **supply-demand ratio** rose to **4.3:1.**

The *Current Market Data* section of this Report lists six natural uranium sales, involving approximately 1.2 million pounds equivalent U_3O_8 in the near term. Five of the transactions involved near-term delivery and three met the criteria for inclusion in the current Transaction Value calculation. Two transactions involved natural UF_6.

The **Transaction Value** is **$17.15** per pound U_3O_8, up $0.05 since last month. The calculation extends over a 4-month period and includes 13 transactions involving 2.1 million pounds equivalent U_3O_8.

The **UF_6 Value** is **$48.25** per kilogram U in UF_6, down $0.25 since last month.

The **Conversion Value** is **$1.80** per pound U in UF_6, down $0.10 since last month. Active supply of secondary market conversion services for delivery within three years totals 1.7 million pounds U as UF_6. Active demand totals 565 thousand pounds U as UF_6. Three secondary market conversion transactions are reported.

The **Loan Rate** declined to **4 percent** per annum, down one percent.

* * *

The Exchange Value declined to $17.00, as the market for natural uranium concentrates weakened during May. Before the end of the month, substantial quantities of material became available at prices below last month's Exchange Value, and at least two transactions for significant quantities of concentrates took place at prices below $17.25. The slow upward movement of spot market prices that began in mid-1985 appears to have been interrupted due to increasing competition for sales and the willingness of sellers to lower their offering prices. Perhaps most important, demand for concentrates remains extremely thin, and an abundance of supply entering the market this month raised the supply-demand ratio to 4.3 to 1. A combination of purchases and withdrawals from the market reduced near-term demand to under one million pounds U_3O_8 equivalent.

The overall weakness in the market has now extended to the UF_6 market, as the UF_6 Value fell slightly; yet some demand still exists. An inquiry by a US utility to purchase a substantial quantity of UF_6 for near-term delivery, along with another utility's request, appeared early in the month, and both were filled quickly. However, a third UF_6 inquiry involving a large quantity was withdrawn by the potential buyer. Moreover, an earlier inquiry to purchase almost three million pounds U_3O_8 disappeared as the buyer declined all offers and withdrew from the market. Because that inquiry was discretionary in nature, the buyer was particularly price sensitive.

During the past few months, one unidentified seller has been and continues to be particularly aggressive in responding to every opportunity to offer material. In addition, some sellers are reducing effective prices by agreeing to longer payment terms or agreeing to accept current price levels for delivery as far in the future as the first quarter of 1987. In the past, such actions have often been a precursor to further price weakening.

Last month Nuexco noted that the price recovery that had been underway might be interrupted as a consequence of the market reaction to the Chernobyl accident, and that does appear to be the case. If so, it is evidence that the market is reacting far more rapidly than it did following the Three Mile Island Unit 2 accident in March 1979, when prices remained stable for several months before starting to decline. The complete extent of delays in plant start-ups, deferrals and any cancellations because of Chernobyl will not be apparent for months. Despite a few widely reported announcements, it is somewhat premature to comment, other than in a general sense, on the accident's eventual impact on the uranium market.

In the longer-term market, at least five utilities in the USA and abroad are in the final stages of selecting and negotiating supply arrangements with producers for deliveries beginning in the late 1980s. To date, these longer-term negotiations do not appear to have been significantly affected by developments in the spot market. Non-US producers continue to experience considerable success in the US market, in most cases reflecting their ability to offer the quantity flexibility and lower prices associated with large, lower-cost operations.

* * *

The Conversion Value dropped back to $1.80, as three secondary market transactions took place at prices slightly above and below that price. There is increased supply for secondary market conversion services, but the gap between sellers' offering prices and prices buyers are willing to pay has widened. The availability of UF_6, as well as only discretionary interest on the part of buyers, contributed to the decline in the Conversion Value. The algebraic sum of the Exchange Value and Conversion Value now closely approximates the UF_6 Value.

The Loan Rate declined to four percent per annum, a one-percent drop. At least one potential lender has indicated a willingness to loan material at that rate. Moreover, the gradual decline of interest rates in all sectors over the past year eventually requires that companies with excess uranium inventories wish-

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ing to lend adopt a lower rate. Because there are very few participants in the uranium lending market, however, changes in commercial interest rates are not felt as quickly. Despite the complications involved in arranging the necessary security, a lower rate could stimulate the emergence of borrowers and some lending activity in a market that has been nearly dormant for several years.

* * *

ENRICHED URANIUM AND SWUS

The **SWU Value** as of May 31, 1986, is $75 per SWU, down $5 since last month. This refers to SWU at a tails assay of 0.30 weight-percent U_{235} and for delivery within one year. No secondary market SWU transactions are reported this month.

One utility, now negotiating for the purchase of a large quantity of secondary market enrichment services, represented the only active opportunity during May. No other active buyers are in the market at present, and the availability of significant quantities of SWU offered at prices well below $80 reflects a weakening in the market, causing the SWU Value to decline. Nevertheless, small quantities of SWU might still command prices close to the $80 level.

* * *

The US Department of Energy has narrowed the list of possible sites for the high-level nuclear waste repository to three locations in the western and southwestern United States — Hanford, Washington; Yucca Mountain, Nevada; and Deaf Smith County, Texas. Efforts to locate sites for a second repository in the East and Midwest have been dropped. DOE plans to select one of the three sites by 1994. In upcoming Reports, Nuexco will examine the US government plans for all types of nuclear waste management.

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CURRENT MARKET DATA

May 31, 1986	Market Values	Active Supply[1] (thousands)	Active Demand[1] (thousands)
EXCHANGE VALUE	**$17.00**/lb. U_3O_8	4,215	975
UF_6 VALUE	**$48.25**/kgU		
CONVERSION VALUE	**$1.80**/lb. U as UF_6	1,700	565
SWU VALUE 0.3 tails assay; delivery within one year	$75/SWU		
LOAN RATE	4%/annum	0	0

	$/lb. U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
TRANSACTION VALUE	**17.15**	2.1	13	4

[1] Supply and demand tables in *Current Market Data* section of this Report detail the numbers for each category.

DEFINITIONS

1. The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.
2. The **UF_6 Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.
3. The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.
4. The **SWU Value** represents Nuexco's judgment of the price at which transactions for the sale of significant quantities of SWUs of stated origin for delivery in the specified time period could be concluded as of the date indicated.
5. The **Loan Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.
6. The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
   a. Transactions closed within the previous three-month period for which delivery is scheduled within one year of the transaction date;
   b. At least ten transactions;
   c. Transactions involving a sum total of at least 2 million pounds U_3O_8 equivalent.

   The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

DERIVATIONS AND COMMENTS

1. All Market Values are based on:
   a. Data from recently completed transactions.
   b. Data from pending transactions.
   c. Firm bids to buy or borrow, and firm offers to sell or lend.
   d. Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell or lend.
2. Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these Market Values.
3. In the determination of the Conversion Value, Nuexco does not consider transportation charges other than those customarily provided by primary suppliers of conversion services.
4. The prices of conversion services or SWUs delivered under long-term contracts with primary suppliers are not considered in the determination of either the Conversion Value or SWU Value.
5. For the SWU Value, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight-percent U_{235} and a product assay of 3.0 weight-percent U_{235}, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
6. In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

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CURRENT MARKET DATA

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
Country (currency)	This Month (May 31, 1986)	Last Month (Apr 30, 1986)	12 Months Ago (May 31, 1985)	This Month (May 31, 1986)	Last Month (Apr 30, 1986)	12 Months Ago (May 31, 1985)
Australia (dollar)	23.64	23.31	22.56	61.47	60.60	58.64
Belgium (comm. franc)	796.25	762.95	931.68	2,070	1,983	2,422
Canada (dollar)	23.41	23.79	20.64	60.86	61.84	53.67
Finland (markka)	89.62	84.98	95.97	232.98	220.92	249.50
France (franc)	124.82	119.46	140.98	324.49	310.57	366.51
FRG (mark)	39.21	37.51	46.30	101.93	97.51	120.36
Italy (lira)	26,759	25,723	29,492	69,567	66,875	76,674
Japan (yen)	2,923	2,893	3,773	7,599	7,521	9,810
Netherlands (guilder)	43.93	42.28	52.16	114.20	109.92	135.59
South Africa (rand)	39.44	35.46	29.97	102.54	92.18	77.92
Spain (peseta)	2,484	2,384	2,612	6,457	6,198	6,792
Sweden (krona)	123.91	120.88	133.45	322.13	314.27	346.95
Switzerland (franc)	32.46	31.37	39.00	84.39	81.55	101.40
UK (pound)	11.42	11.14	11.77	29.68	28.97	30.61
US (dollar)	17.00	17.25	15.00	44.20	44.85	39.00

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
Country (currency)	This Month (May 31, 1986)	Last Month (Apr 30, 1986)	12 Months Ago (May 31, 1985)	This Month (May 31, 1986)	Last Month (Apr 30, 1986)	12 Months Ago (May 31, 1985)
Australia (dollar)	23.85	23.11	21.73	62.01	60.08	56.49
Belgium (comm. franc)	803.28	756.30	897.52	2,088	1,966	2,333
Canada (dollar)	23.62	23.58	19.89	61.40	61.30	51.70
Finland (markka)	90.41	84.24	92.45	235.04	219.00	240.35
France (franc)	125.92	118.42	135.81	327.36	307.87	353.07
FRG (mark)	39.55	37.18	44.60	102.83	96.66	115.95
Italy (lira)	26,995	25,500	28,411	70,181	66,293	73,863
Japan (yen)	2,949	2,868	3,635	7,666	7,455	9,450
Netherlands (guilder)	44.32	41.91	50.24	115.21	108.96	130.62
South Africa (rand)	39.79	35.15	28.87	103.45	91.38	75.06
Spain (peseta)	2,505	2,363	2,516	6,514	6,144	6,543
Sweden (krona)	125.00	119.83	128.56	324.97	311.54	334.22
Switzerland (franc)	32.75	31.10	37.57	85.14	80.84	97.68
UK (pound)	11.52	11.05	11.34	29.94	28.72	29.49
US (dollar)	17.15	17.10	14.45	44.59	44.46	37.57

[1] Calculated using currency exchange rates published in the *Wall Street Journal* on May 30, 1986.

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CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U as UF_6			per kg. U as UF_6		
Country (currency)	**This Month (May 31, 1986)**	**Last Month (Apr 30, 1986)**	**12 Months Ago (May 31, 1985)**	**This Month (May 31, 1986)**	**Last Month (Apr 30, 1986)**	**12 Months Ago (May 31, 1985)**
Australia (dollar)	2.50	2.57	2.26	5.52	5.66	4.97
Belgium (comm. franc)	84.31	84.03	93.17	185.87	185.26	205.40
Canada (dollar)	2.48	2.62	2.06	5.46	5.78	4.55
Finland (markka)	9.49	9.36	9.60	20.92	20.63	21.16
France (franc)	13.22	13.16	14.10	29.14	29.01	31.08
FRG (mark)	4.15	4.13	4.63	9.15	9.11	10.21
Italy (lira)	2,833	2,833	2,949	6,246	6,246	6,502
Japan (yen)	309.49	318.63	377.36	682.31	702.46	831.93
Netherlands (guilder)	4.65	4.66	5.22	10.25	10.27	11.50
South Africa (rand)	4.18	3.91	3.00	9.21	8.61	6.61
Spain (peseta)	262.97	262.58	261.28	579.74	578.88	576.02
Sweden (krona)	13.12	13.31	13.35	28.92	29.35	29.42
Switzerland (franc)	3.44	3.46	3.90	7.58	7.62	8.60
UK (pound)	1.21	1.23	1.18	2.67	2.71	2.60
US (dollar)	1.80	1.90	1.50	3.97	4.19	3.31

SWU VALUE AND UF_6 VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	**SWU Value delivery within one year (May 31, 1986)**	**UF_6 Value per kg.U in UF_6 This Month (May 31, 1986)**	**UF_6 Value per kg.U in UF_6 Last Month (Apr 30, 1986)**
Australia (dollar)	104.31	67.11	65.54
Belgium (comm. franc)	3,513	2,260	2,145
Canada (dollar)	103.28	66.44	66.88
Finland (markka)	395.36	254.35	238.92
France (franc)	550.66	354.26	335.87
FRG (mark)	172.97	111.28	105.46
Italy (lira)	118,054	75,948	72,323
Japan (yen)	12,895	8,296	8,133
Netherlands (guilder)	193.80	124.68	118.87
South Africa (rand)	174.01	111.95	99.69
Spain (peseta)	10,957	7,049	6,703
Sweden (krona)	546.65	351.68	339.87
Switzerland (franc)	143.21	92.13	88.20
UK (pound)	50.37	32.40	31.33
US (dollar)	75.00	48.25	48.50

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on May 30, 1986.

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CURRENT MARKET DATA

RECENT TRANSACTIONS[1]

Uranium Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price as Percent of Current Exchange or UF_6 Value	Seller	Buyer	Remarks
3737	1986-1987	50-100	R[5]	US Producer	Trader	
3736	1986	101-300	R[5]	R[5]	US Utility	UF_6.
3731	1986	601-1,000	101	Canadian Producer	US Utility	UF_6.
3730	1988-1993	1,001-1,500	see remarks	Canadian Producer	US Utility	Market-related price.
3724	1986	50-100	99	US Producer	US Producer	
3719	1986	101-300	100	US Producer	Trader	

Conversion Services
Secondary Market Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U equivalent)	Approximate Price as Percent of Current C.V.	Seller	Buyer	Remarks
3738	1986	50-100	103	R[5]	US Utility	
3735	1986	less than 50	100	Trader	Trader	
3708	1986	301-600	94	US Utility	European Entity	

[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] If tails assay is unknown or unspecified, Nuexco's calculation of SWU quantity assumes 0.20 w/o tails assay.

[3] Price is not normalized to 0.20% tails assay.

[4] Refers to SWU Value that corresponds to SWUs included in transaction. When prices and SWU values are expressed as discounts (e.g. X dollars less than DOE's USEC base price at time of delivery), the percentage refers to the ratio of the *discounts*, not the ratio of the prices.

[5] The notation *R* means that Nuexco either does not know, or that Nuexco has restricted that information to protect client confidentiality.

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URANIUM SUPPLY
(May 31, 1986)

Nuexco Project Number	Spot or Near-term[2]	Intermediate or Long-term	Remarks
	Delivery Period[1] (Thousands of Pounds U_3O_8)		
Available for Sale:			
ACTIVE			
2335	400	—	
2740*	100	—	
2777	500	—	
2810	195	175	UF_6
2826*	230	—	UF_6
2933	300	300 per year	
2967*	500	—	
2989*	40	—	
3023	750	500	UF_6
3121*	1,200	—	
2263	—	400 per year	1987 on
2625	—	500 per year	1987 on
2781*	—	250 per year	1988-95
2927*	—	220 per year	1987-90
TOTAL	4,215		
INACTIVE			
2297*	200	200 per year	1988-89
2336	250	250 per year	1987-94
2389	75	75 per year	1987-90
2703	750	—	
2764	260	—	UF_6
2765	260	—	UF_6
2813*	30	—	
2853	65	—	
2871	50	—	
TOTAL:	2,040		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2778, 2851, 2919.

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CURRENT MARKET DATA

URANIUM DEMAND
(May 31, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or long-term	Remarks
Inquiries to Purchase:			
ACTIVE			
2681*	500	500 per year	UF_6 or U_3O_8; 1988
2782*	350	900	1988
2839*	100	—	UF_6
2943	25	—	UF_6
2217	—	1,000 per year	1989-95
2507	—	600	1987-89
2738	—	1,000	1989 on
2760	—	750 per year	1987-90
2850	—	300 per year	1990-95
TOTAL:	975		
INACTIVE			
2661	250	250 per year	1986-87
2733	500	500 per year	1987-95
2784	100	—	
2798	70	—	
2845	400	—	
TOTAL:	1,320		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2586, 2770, 2806, 2821, 2858, 2870, 2915, 2930.

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LOAN SUPPLY AND DEMAND
(May 31, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Within 1 Year	Beyond 1 Year	Remarks
Available for Loan:			
INACTIVE			
1938	2,000	—	UF_6
2036	500	—	
2667	800	—	
2920	2,000	—	
TOTAL:	5,300		

*New or revised since last month.
[1] Measured from the date of this Report.
Projects removed since last month: None.

No inquiries to borrow are reported this month.

CONVERSION SUPPLY AND DEMAND
(May 31, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U as UF_6) Within 3 Years	Beyond 3 Years	Remarks
Available for Sale:			
ACTIVE			
2849	550	500	1987-90
2859*	750	750	
2988*	400	500	
TOTAL:	1,700		
Inquiries to Purchase:			
ACTIVE			
2833	400	—	
2974*	165	—	
TOTAL:	565		

*New or revised since last month.
[1] Measured from the date of this Report.
Projects removed since last month: 2717, 2826, 2920, 2925.

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CURRENT MARKET DATA

SWU SUPPLY AND DEMAND
(May 31, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of SWUs) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
2571	—	55	1987
2873	40	—	
2914	15	—	
2953	200	—	
TOTAL:	255		
INACTIVE			
2410A	340	—	
TOTAL:	340		
Inquiries to Purchase:			
INACTIVE			
2878*	10	—	
2879*	250	—	
TOTAL:	260		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes SWUs deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 3024.

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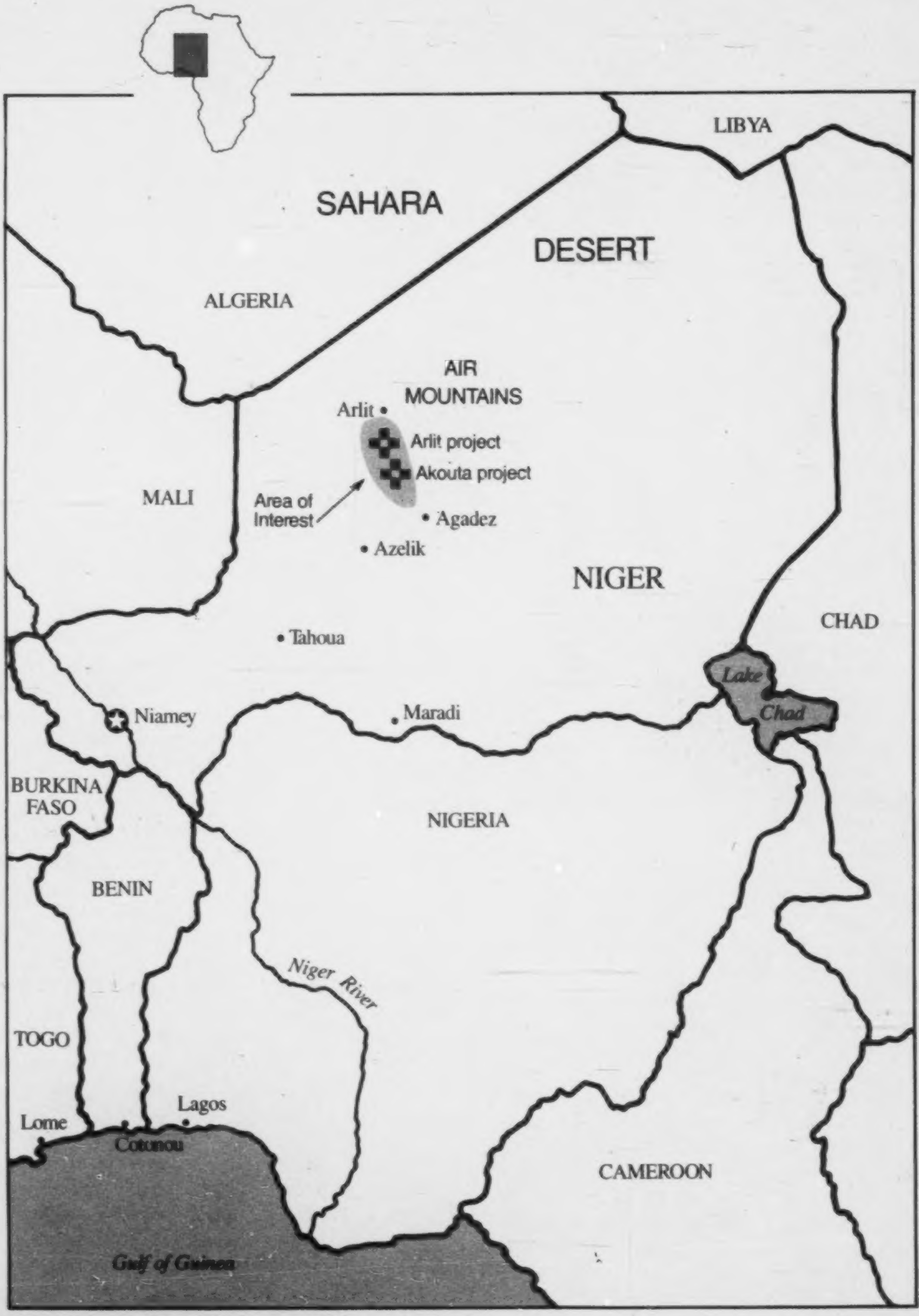
LIBYA
SAHARA
DESERT
ALGERIA
AIR
MOUNTAINS
Arlit
Arlit project
Akouta project
MALI
Area of
Interest
Agadez
Azelik
NIGER
CHAD
Tahoua
Lake
Chad
Niamey
Maradi
BURKINA
FASO
NIGERIA
BENIN
Niger River
TOGO
Lagos
Lome
Cotonou
CAMEROON
Gulf of Guinea

Figure 1. Location map shows operating projects and area of interest for uranium production in Niger.

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Table 1
ORIGINAL AND CURRENT OWNERSHIP OF SOMAIR[1]

Original Shareholder	**Country**	**Percent**	**Current Shareholder**	**Country**	**Percent**
Onarem[2]	Niger	33.000	Onarem	Niger	33.000
Cogema[3]	France	26.961	Cogema	France	26.961
CF Mokta[4]	France	19.378	Sogerem[5]	France	19.378
Minatome	France	7.583	UPUK[6]	France	7.583
Urangesellschaft mbH	FRG	6.539	Urangesellschaft mbH	FRG	6.539
AGIP Uranio	Italy	6.539	AGIP Uranio	Italy	6.539
		100.000			100.000

[1] Somair = Société des Mines de L'Air.
[2] Onarem = Office National des Ressources Minière.
[3] Cogema = Compagnie Générale des Matieres Nucleaires.
[4] CF Mokta = Compagnie Francaise Mokta.
[5] Sogerem = Société Générale des Recherches et d'Exploitation Minières.
[6] UPUK = Uranium Pechiney Ugine Kuhlmann.

While Somair's owners determine the following year's production rate, they are not required to purchase any of that output. Thus, the owners have access to long-term uranium supply without having an obligation to buy in any particular year. This has been the chief cause of reduced operations at Arlit, as Cogema and Onarem were the only owners that purchased the production output in 1985; the other owners declined the option to buy Arlit uranium that year. In 1984, only Cogema and Urangesellschaft purchased Arlit output.

Cominak and the Akouta Project

Niger's only other active production site is located at Akouta, 10 kilometers south of Arlit. The underground mine began production in 1978 and has an annual capacity of nearly six million pounds U_3O_8. Production in 1985 totaled 5.2 million pounds U_3O_8, over 60 percent of Niger's output for the year. In general, grades at Akouta are higher than at Arlit. The acid-leach mill has an annual capacity of about 5.7 million pounds U_3O_8.

Cogema has the largest ownership interest in Cominak (Compagnie Minière d'Akouta), as shown in Table 2, and is the project operator. Cominak's administrative structure is similar to that of Somair. Unlike the Somair operation, however, Cominak owners must purchase their percentage share of each year's production. From 1979 to 1982, the mine produced at almost full capacity and all of the owners purchased their shares. Since 1983, the French, Spanish and Japanese owners have purchased all of Cominak's annual production, including Onarem's share; Onarem has not marketed any of its own output. However, the mine has been operating at a slightly reduced rate of 5.2 million pounds U_3O_8 per year. In an effort to increase head grades at the mill, since 1984 Cominak has operated a backfilling and pillar-robbing mining system in high-grade areas that had been mined previously.

Table 2
OWNERSHIP OF COMINAK[1]

Shareholder	**Country**	**Percent**
Cogema[2]	France	34.0
Onarem[3]	Niger	31.0
OURD[4]	Japan	25.0
ENUSA[5]	Spain	10.0
		100.0

[1] Cominak = Compagnie Minière d'Akouta
[2] Cogema = Compagnie Générale des Matieres Nucleaires.
[3] Onarem = Office National des Ressources Minière.
[4] OURD = Overseas Uranium Resources Development Corporation.
[5] ENUSA = Empresa Nacional de Uranio SA.

Price Relationship

While most world market uranium prices are quoted in US dollars per pound U_3O_8, the price of Nigerien uranium is quoted in Central Africa Francs per kilogram of uranium (CFA/kgU). The CFA is tied to the French franc (FF) at a constant rate of 50 CFA per French franc. Thus, the fluctuations between the French franc and the US dollar directly affect the CFA/US dollar relationship. To compare the price of Nigerien uranium to US dollar-denominated prices at a given time requires the conversion from KgU to pounds U_3O_8 (2.5998 lbs. U_3O_8 per kgU), the 50 CFA per FF constant, and the French franc to US dollar exchange rate at the time. The following equations illustrate this point.

Assuming the Nigerien uranium price is 30,000 CFA/kgU:
When the French franc/US dollar exchange rate is 9.38 FF/US$, then

$$\frac{30{,}000\ \text{CFA/kgU}}{(9.38\ \text{FF/\$})\ (50\ \text{CFA/FF})\ (2.5998\ \text{lbs. } U_3O_8\text{/kgU})}$$

$$= \mathbf{\$24.60\ per\ pound\ } U_3O_8$$

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When the French franc/US dollar exchange rate is 6.89 FF/US$, then

$$\frac{30{,}000\ \text{CFA/kgU}}{(6.89\ \text{FF/\$})\ (50\ \text{CFA/FF})\ (2.5998\ \text{lbs.}\ U_3O_8\text{/kgU})}$$

$$= \mathbf{\$33.50\ per\ pound\ U_3O_8}$$

Thus, the US dollar price of Nigerien uranium at any given time depends upon exchange rates and the strength of the French franc in relation to the US dollar. The 1985 posted price for Nigerien uranium was 30,000 CFA/kgU. On December 31, 1985, the exchange rate was 7.55 FF/$, so that the US dollar price of Nigerien uranium at the end of 1985 was $30.57 per pound U_3O_8; at the same time the Nuexco Exchange Value was $17.00.

Other Projects

Several planned operations and exploration programs were in effect throughout the 1970s and 1980s. Some are idle due to poor market conditions and other reasons, and some exploration programs continue at a reduced pace.

1. *Société de Tassa N'Taghalgue (SMTT).* SMTT was to have been an open pit mine located adjacent to the Somair mine on the Arlit concession. Onarem, Cogema, and the government of Kuwait each own about one-third of SMTT. The project was scheduled to begin production in 1979, but the only work on the project was performed in 1982 and 1983 by Somair staff. There had been reports that Somair operations might be shifted to the SMTT site, but no agreement between Somair and SMTT has been announced. The project remains idle.

2. *Imouraren.* This project was to have been Niger's largest mine. It consists of an extremely large, low-grade deposit amenable to open-pit mining. Mineable reserves reportedly exceed 180 million pounds U_3O_8. The ownership consists of Cogema (35 percent), Conoco Minerals (USA; 35 percent), and Onarem (30 percent). The administrative structure would have been similar to Cominak's; each owner would be obligated to purchase its share of production. Scheduled to begin production in 1982, the project failed to gain final commitments and lingered until 1983 when Conoco abandoned the venture and forfeited its claims to the reserves.

3. *Afasto East.* Located on the Techili concession, this exploration program involves Onarem, Saarburg Interplan Uran (Federal Republic of Germany), Central Electricity Generating Board (United Kingdom), and the government of Nigeria.

4. *Afasto West.* Located south of the Arlit mines, the Afasto West deposits are small, widely scattered, but contain good grades. In 1975, Onarem, Cogema, and OURD (Japan) began exploration, but no economic mines were developed. The partners are delaying any further work until the uranium market strengthens.

5. *Sekiret.* This concession is located south of Arlit and was leased in 1981 to an exploration partnership consisting of Onarem and Power Reactor and Nuclear Fuel Development Corporation [PNC] (Japan). As of 1985 the partners were still planning to continue prospecting on the concession.

6. *Teguidda N'Teesoum (TGT).* Located on the Abakorum concession, TGT reportedly has some 39 million pounds U_3O_8 of reserves. Formed in 1975 by Onarem and International Resources, SA [IRSA] (Japan), its exploration permit was renewed in 1984.

Outlook

Cogema currently purchases over half of the output from both the Cominak and Somair operations, and may continue to do so through the 1980s. Cominak's owners appear to be committed to maintaining the current production level, so output should remain constant into the 1990s. Recently, however, some of Somair's owners, who are not required to purchase their respective shares of the output, have chosen not to do so. Somair's declining production, currently supported by Cogema purchases, may lead to a shutdown of operations by the 1990s, reducing Niger's production to slightly more than five million pounds U_3O_8 annually. Moreover, until the uranium market strengthens significantly, the future of planned projects in Niger is uncertain.

The problems for Niger as a supplier nation in a weak uranium market have been compounded by the effects of inflation, general weakness of the French franc during the early 1980s, and a pricing policy that is unrelated and unresponsive to spot market realities. While this situation may be acceptable to owners/customers whose primary concern is long-term supply, it has effectively inhibited near-term sales in the world market. For these reasons, Onarem's periodic attempts to market its share of production to customers other than the co-owners have met with limited success. Recently, however, there have been some indications that past policies may be reconsidered and steps may be initiated that would result in higher ore grades, reduced costs, and more flexible pricing arrangements. Without such efforts, Niger's production will remain a function of how its investors value captive production from Niger compared to other sources available in the world market.

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AUSTRALIA

In an unexpected turn of events at the end of May, the proposed transaction under which Pioneer Concrete Services Ltd. would have purchased North Broken Hill's 30-percent equity interest in ERA was canceled. (See Report 213, May 1986). One day later, Pioneer Concrete itself became a target of a take-over attempt mounted by FAI Insurances, Ltd., the financing vehicle utilized by Mr. Lawrence J. Adler. The reasons for the collapse of the Pioneer-North Broken Hill deal are not entirely clear as of press time, but some factors are apparent. It was not clear whether certain rights of first refusal would be transferred to Pioneer upon its purchase of the North Broken Hill shares. Lacking such rights, Pioneer could find itself locked into a minority position in relation to Peko Wallsend (PEKO), the other major ERA shareholder. Such a possibility was undoubtedly seen as unacceptable by Pioneer. Complicating this situation is a reported power struggle within ERA involving PEKO's attempts to gain increased control and the reported reluctance of ERA's foreign customer/shareholders to see PEKO gain such control.

The Australian financial community generally believes that North Broken Hill must dispose of its interest in ERA, but in question is what entity will acquire that interest. There are also reports that PEKO wishes to gain majority control of ERA, and, with the effective power to block purchase by others, is itself considering the acquisition of North Broken Hill's shares, albeit at a lower price. Equally uncertain at this time is the future of Pioneer Concrete and that of Queensland Mines, viewed as one of Pioneer's more valuable holdings.

* * *

In early May, the Olympic Dam (Roxby Downs) joint venture partners, Western Mining Corporation and the BP Group, took the final step in the initiation of the Olympic Dam project, by issuing the formal advice to the government of South Australia of their intent to proceed with the project as required under the Roxby Downs Indenture Ratification Act of 1982. The only change from their December 1985 decision to commit was the announcement that a $40 million copper refinery would be built and that the copper product would be in the form of cathode rather than blister, as previously planned. Aggressive marketing of the uranium production continues, and while no supply contracts have yet been announced, reports persist that at least one letter of intent is in place and that discussions with other potential customers are in progress.

* * *

In Report 212 (April 1986), Nuexco noted that Energy Resources of Australia (ERA) faced a potentially serious legal challenge to the validity of its permit for its Ranger mining operation in the Northern Territory. The High Court of Australia, however, has ruled that the amendment to the Atomic Energy Act of 1980, under which ERA mines the Ranger deposit, is indeed valid. The Northern Land Council, an Aboriginal body, had challenged the amendment in an apparent attempt to exert more control over ERA and its operations, but the Court's ruling appears to settle the matter totally in favor of ERA. The amendment provides that ERA could carry on operations at Ranger as if done on behalf of and authorized by the Australian government.

THE NETHERLANDS

In recent parliamentary elections, the government of Prime Minister Ruud Lubbers, part of a center-right coalition of Christian Democrats and Liberals, unexpectedly emerged with the same majority of seats in the Dutch parliament as it held after the last election in 1982. The fate of nuclear power in the Netherlands, particularly the future of two planned units, may be closely tied to the results.

In the wake of the Chernobyl accident, opinion polls reflected a noticeable shift in the Dutch public's view of nuclear power and predicted the incumbent government's defeat by the moderate left, namely the Labor Party. Prime Minister Lubbers and his coalition government had modified their views on nuclear power prior to the election, suddenly postponing plans to build two new reactors. Despite that action, support for the Labor Party, which was campaigning on a platform calling for the abandonment of nuclear energy, increased following the Chernobyl accident. A Labor Party victory would have almost certainly signalled a total retreat from nuclear power in the Netherlands, where utilities have been hindered by anti-nuclear politics since the mid-1970s.

In a debate prior to the election, the Prime Minister assured voters that the future of nuclear power was uncertain until safety questions raised by the Chernobyl accident were answered. The incumbent government managed to secure 81 seats in the 150-seat parliament, and although the Labor Party made some progress, gaining about five seats, it conceded defeat only one hour after the polls had closed. Its gains mostly came at the expense of smaller parties. Voter turnout was reported to be very large.

Considering the unexpected vote of confidence given to Prime Minister Lubber's government and its policies, it is likely that the plans to install 2,000 MWe of nuclear generating capacity by 1995 eventually will proceed, perhaps after safety studies are concluded. In June 1985, parliament approved the cabinet plan to build more nuclear units, and it approved the government's site recommendations for the new units in January 1986. The preferred site is at Borssele, where the Netherlands' largest existing nuclear unit has been operating since 1973.

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UNITED STATES

The Financial Accounting Standards Board (FASB), a private-sector body, has proposed changes in the accounting procedures used by electric utility companies for the effects on their revenues of rate-making decisions by public utility commissions. The seven-member panel consists of senior accountants appointed by trustees of the Financial Accounting Foundation. Standards promulgated by the FASB, primarily in the form of "Statements of Financial Accounting Standards," are recognized as authoritative policy for financial reporting in the private sector.

The proposed Statement, issued by the FASB in December 1985 in the form of an "Exposure Draft" for public comment, will be the subject of a public hearing to be held June 4-6, 1986. More than 70 organizations and individuals, a record number of participants, will testify at the hearings. Opponents of the proposed revision believe that it could well cause the financing of nuclear construction projects to become prohibitively expensive. Some 21 utilities have formed a group called the Committee for Consistent Accounting Practices (CCAP) to lobby the FASB to reconsider the proposed changes at the upcoming hearing. The FASB adopted the exposure draft in December by only a 4 to 3 vote, so sufficient opposition could influence the outcome.

The changes proposed in the "Exposure Draft" of the proposed Statement relate to three specific issues that have increased in importance in the electric utility industry since 1982, when the FASB issued its Statement of Financial Accounting Standard No. 71, entitled "Accounting for the Effects of Certain Types of Regulations." Those issues are

— plant cost "phase-in plans;"

— abandonments of operating assets (plants) or assets under construction;

— disallowance of plant costs for rate-making purposes.

Each of these areas are of significant importance to the electric utility industry, especially utilities having nuclear units, in view of the enormous costs involved in the construction of nuclear power plants.

Among other measures, the proposed changes, if adopted, would affect the financial accounting treatment of the three events in the following manner:

1. *Phase-in of new plant costs*. The costs associated would be capitalized provided that the phase-in plan (to defer costs for recovery through the rate process in future years) has been approved by the applicable regulatory authority, the duration of the recovery period to recognize such deferred costs is specified in the plan, and all deferred amounts are to be recovered within ten years of the plan's inception.

2. *Plant abandonments*. The book value of an abandoned plant would be presented (for financial statement purposes) at the lesser of its costs *or* the present value of probable future revenues allowed for rate-making purposes by the appropriate regulatory authority. Any excess of current book value over the amount determined above would be recognized as a loss in the period when realized.

3. *Disallowances*. It would require any disallowed costs of a newly completed plant to be recognized as a *current period loss* on the utility's financial statements.

During 1984, rate problems related to new nuclear electric generating plants of several utilities were widely discussed in the financial press. Rising costs of nuclear plant construction, often totaling billions of dollars, were especially prominent. At question was whether the utilities could establish rates based on the cost of those plants without losing a major part of their customer base. Some articles indicated that phase-in plans were likely for certain of those utilities, but they raised significant questions about the assurance of cost recovery in future periods. Representatives of some regulatory commissions began to question the cost of some of those new plants and to discuss possible major disallowances. Also, several plants in advanced stages of construction were abandoned. In a few states, courts ruled that utilities could recover the costs of those abandoned plants from customers.

When a utility completes a new plant, current accepted rate-making procedures provide for the recovery in allowed rates of the current operating costs of the plant, including depreciation, interest, and a fair rate of return on shareholders' investment. In recent years, however, the cost of constructing new plants has been much greater than in the past, and conventional rate-making procedures often have resulted in significantly increased rates for some utilities. Phase-in plans were designed to mitigate the effects of such sudden "rate shock." Part of the current operating costs related to a new plant that normally would be recovered through current rates were deferred for recovery in future years by utilizing phase-in plans, which were not specifically addressed in Statement No. 71 when it was issued in 1982.

The Exposure Draft would affect most of the utilities which have brought nuclear-generating plants into operation in the last few years and have faced rigorous cost prudency hearings from public utility commissions. The position on those issues, when finally adopted by the FASB in a Statement of Financial Accounting Standards, may well establish a pattern regarding the appropriate accounting for rate-regulated utilities in all regulatory jurisdictions, as well as for the recovery of long-lived assets outside the regulatory environment.

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The Exposure Draft would be effective for fiscal years beginning after December 15, 1986 and would apply to:

— existing and future phase-in plans,

— recorded costs of previously abandoned assets and of assets for which abandonment is probable in the future,

— previously disallowed plant costs and disallowances of plant costs that are probable in the future.

Restatement of financial statements for prior fiscal years would be permitted but not required. Because the proposed changes would apply retroactively, however, many utilities strongly oppose the amendment, emphasizing that utilities that financed plant construction projects under existing procedures should not be penalized by a revision of those procedures. Due to the large capital costs and demonstrated financial risks associated with nuclear plant construction, many utilities fear that such new accounting procedures, if adopted, would effectively prohibit the nuclear option for future plant additions.

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AMPLIFICATIONS

In the article on World Uranium Production in Report 213 (May 1986), a reference was made to an expected increase in production at "Saskatchewan Mining Development Corporation's Key Lake operation." In actuality, the Key Lake project is operated by Key Lake Mining Company, which is owned by SMDC (50 percent), Uranerz Exploration and Mining (33.3 percent), and Eldor Resources Limited (16.7 percent).

Two items in the 1985 Annual Review, published in March 1986, warrant correction.

1. In the article on Spain (page 35), the reasonably assured resource figure of 35 million pounds U_3O_8 is erroneous. Table 3 separates Spain's Reasonably Assured Resources (RAR) and Estimated Additional Resources (EAR) by cost category, demonstrating that RAR recoverable at costs less than \$80 per kgU total 26,700 metric tons U, or 69 million pounds U_3O_8. Total RAR exceed 85 million pounds U_3O_8.

2. In Figure 5 on page 30, entitled "German Ownership in Active Uranium Production and Trading Operations," the ownership percentages shown for Steag AG are incorrect. Neither RWE, VEW, nor Veba AG have any *direct* ownership interest in Steag. Rather, their interests in Steag are held through their ownership of two companies that in turn own over 95 percent of Steag. These relationships are detailed in the top portion of Table 4. The bottom portion of the table indicates the *net effective* ownership interests in Steag. Figure 2 shows the revised German ownership percentages.

Table 4

OWNERSHIP OF STEAG AG AND ITS PRINCIPAL SHAREHOLDERS

Shareholder		**Percent**
Ruhrkohle AG		71.08
Owned by		
Veba AG	37.1	
BGE[1] (subsidiary of VEW[2])	21.7	
Thyssen Stahl AG	12.7	
Montan Verwaltungsgesellschaft mbH	10.0	
Verwaltungsgesellschaft Ruhrkohle-Beteiligungs mbH	10.0	
Societe Nouvelle Sidechar	8.3	
Gewerkschaft Alte Haase	0.2	
	100.00	
Gesellschaft fuer Energiebeteiligung mbH		25.84
Owned by		
RWE[3]	44.6	
Veba Kraftwerke Ruhr AG (subsidiary of Veba AG)	29.1	
Veba AG	26.3	
	100.0	
Other Shareholders		3.08
		100.00
Net Effective Ownership in Steag AG		
Veba AG	40.69	
VEW	15.42	
RWE	11.53	
Other	32.36	
	100.00	

[1] BGE = Beteiligungsgesellschaft fuer Energieunternehmen mbH.
[2] VEW = Vereinigte Elektrizitaetswerke Westfalen AG.
[3] RWE = Rheinisch-Westfaelisches Elektrizitaetswerk AG.

Table 3

URANIUM RESOURCE ESTIMATES IN SPAIN[1]

Metric tons Uranium
(Pounds U_3O_8)

Reasonably Assured Resources (RAR) Recoverable at Costs		**Estimated Additional Resources (EAR) Recoverable at Costs**	
Less than \$80/kgU	**Between \$80/kgU and \$180/kgU**	**Less than \$80/kgU**	**Between \$80/kgU and \$180/kgU**
26,700	6,200	9,000	—
(69,415,000)	(16,120,000)	(23,400,000)	—

[1] SOURCE: Empresa Nacional del Uranio, S.A. (ENUSA).

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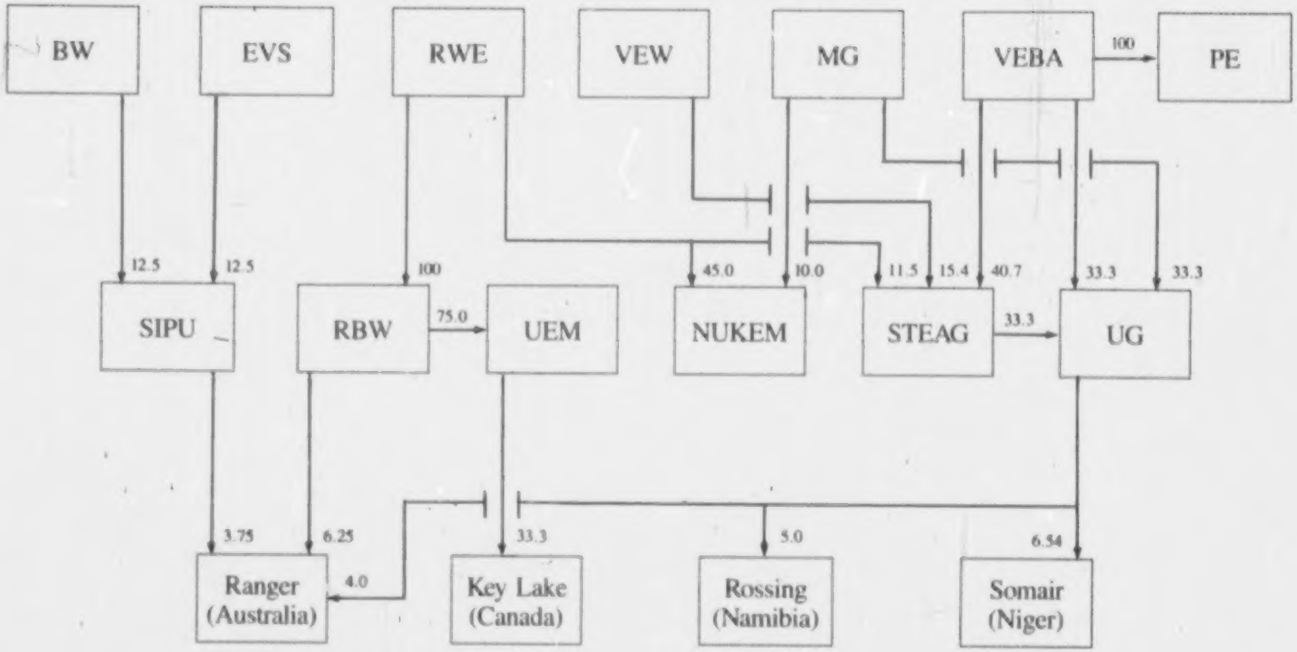
Figure 2

GERMAN OWNERSHIP IN ACTIVE URANIUM PRODUCTION AND TRADING OPERATIONS


BW
EVS
RWE
VEW
MG
VEBA
100
PE
12.5
12.5
100
45.0
10.0
11.5
15.4
40.7
33.3
33.3
SIPU
RBW
75.0
UEM
NUKEM
STEAG
33.3
UG
3.75
6.25
4.0
33.3
5.0
6.54
Ranger (Australia)
Key Lake (Canada)
Rossing (Namibia)
Somair (Niger)

BW — Badenwerk AG
EVS — Energieversorgung Schwaben AG
MG — Metallgesellschaft AG
NUKEM — Nukem GmbH
PE — Preussenelektra AG
RBW — Rheinische Braunkohlenwerke AG
RWE — Rheinisch-Westfaelisches Elektrizitaetswerk AG

SIPU — Saarberg Interplan Uran GmbH
STEAG — Steag AG
UEM — Uranerz Exploration & Mining Co.
UG — Urangesellschaft mbH
VEBA — Veba AG
VEW — Vereinigte Elektrizitaetswerk Westfalen AG

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NUEXCO

RAW MATERIALS

GEOLOGIC CLASSIFICATIONS OF URANIUM DEPOSITS

The following article gives an overview of the manner in which uranium deposits worldwide are classified for exploration and mining purposes. It may serve as a reference guide for different types of uranium mineralization.

Introduction

Uranium is a minor but widespread constituent of the earth's crust. Through the normal processes of geologic change, concentrations of uranium have formed various types of deposits in several different geologic environments. There is considerable differentiation in the characteristics of those deposits, particularly in size, uranium content, genesis, and geologic environment. Because the size and uranium content in a given deposit are subject to uncertainty, the classification of uranium deposits is usually based on genesis and geologic environment.

The classification of uranium deposits has evolved over time. Usually, a scientific body or an international study group attempts to reclassify and further define uranium occurrences, and the results are published for dissemination throughout the mining and exploration industry. Joint publications by the OECD Nuclear Energy Agency and the International Atomic Energy Agency (IAEA), favor the listing of uranium deposits by *geological setting*.[1] Accordingly, world uranium resources have been categorized by type of deposit in one of six specific geologic settings:

1. Quartz-pebble conglomerate deposits;
2. Proterozoic unconformity-related deposits;
3. Disseminated magmatic, pegmatitic and contact deposits in igneous and metamorphic rocks;
4. Vein deposits;
5. Sandstone deposits;
6. Other types of deposits.

Resources in the first five categories need little explanation, as some of the largest, best-defined and exploited deposits fall into these categories. The sixth category includes resources occurring in calcretes, limestones, marine phosphorites, bituminous shales, lignites, and volcanic rocks. These six geologic settings are widely recognized and commonly noted in scientific literature.

The US Department of Energy (DOE), through the National Uranium Resource Evaluation (NURE) program formulated a more detailed procedure for the classification of uranium resources.[2] Based on *ore genesis* and geologic environment, all deposits are assigned to one of the following four categories:

A. Deposits in sedimentary rocks
B. Occurrences in and related to plutonic igneous rocks
C. Volcanogenic uranium deposits
D. Uranium deposits of uncertain genesis.

The fundamental characteristics of the four categories expand on theories of ore genesis within a given geologic environment. Category A details ore genesis in all types of sedimentary rocks, category B is based on the ore-forming process as related to the evolution of igneous rocks, category C deals with staged ore-forming processes associated with a volcanogenic system, and category D describes vein-type deposits related to metamorphic and sedimentary rocks as well as unconformity-related deposits. Deposits in category D are so listed because of the uncertain genesis of associated ore minerals.

Figure 3 illustrates the relationship between the main categories and subgroupings that are used in the NURE system of classification. However, both classification systems are based on the categorization of uranium deposits into easily identifiable groups. Each permits a rapid interpretation and understanding of uranium deposits and establishes a functional relationship between past and future exploration experiences, allowing a better approach for the recognition and evaluation of new exploration projects.

The classification of uranium deposits herein considers both the IUREP and NURE outlines, but the format follows that of the NURE system. It offers a fundamental classification of all types of deposits within a particular geologic environment relative to ore genesis.

A. Deposits in Sedimentary Rocks

Uranium mineralization is known to occur from trace amounts up to million-pound concentrations in at least nine different sedimentary environments. Essentially, the ultimate source of uranium within each environment is considered to be uranium-bearing igneous rocks, but methods by which the uranium was concentrated are divided into two groups: syngenetic deposits formed contemporaneously with deposition of the host sediment, and epigenetic deposits formed by the precipitation of uranium from solutions migrating through a preexisting sedimentary sequence. The origin of solutions can be any combination of interstitial water, surface sources, or hydrothermal solutions emanating from greater depth.

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[1] "Uranium Resources, Production and Demand," December, 1983; and "World Uranium Geology and Resource Potential," by the International Uranium Resources Evaluation Project (IUREP) a joint steering group sponsored by OECD and IAEA, Report on phase 1, page 39, 1980.

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[2] "A preliminary classification of uranium deposits," GJBX-63(78), prepared for DOE by Bendix Field Engineering Corp. (BFEC), May 1978. "Geologic characteristics of environments favorable for uranium deposits," GJBX-67(78), prepared for DOE, by BFEC, 1978.

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GEOLOGIC STRATIGRAPHIC COLUMN			A. Uranium in sedimentary rocks	B. Uranium in plutonic igneous rocks	C. Volcanogenic uranium deposits	D. Uranium deposits of uncertain genesis
ERA	SYSTEM	SERIES (EPOCH)				
Cenozoic		Recent	1,7			
	Quaternary					
		Holocene				
		Pleistocene				
	Tertiary	Pliocene	6			
		Miocene	7		1,2	
					3,4	
		Oligocene				
		Eocene	9			
		Paleocene	9			
Mesozoic	Cretaceous			1,2,3		
			1,6	4,5,6,7		
	Jurassic					
			9			
	Triassic					
			8,9			3
Paleozoic	Permian		4			3
	Pennsylvanian					3
	Mississippian					3
	Devonian		3			
	Silurian					
	Ordovician					
	Cambrian					
Precambrian	Proterozoic	Upper				
		Lower	2	3,7,8		1,2
	Archean		2			1,2

LEGEND

A.
1. Placer deposits
2. Quartz-pebble conglomerates
3. Marine Black Shales
4. Phosphorite
5. Seawater
6. Lignite, coal, carbonaceous shales
7. Evaporative precipitates
8. Limestone
9. Sandstone

B.
1. Orthomagmatic
2. Pegmatitic and aplitic
3. Magmatic-hydrothermal
4. Contact-metasomatic
5. Autometasomatic
6. Authigenic
7. Allogenic
8. Anatectic

C.
1. Initial-magmatic
2. Pneumatogenic
3. Hydroauthigenic
4. Hydroallogenic

D.
1. Unconformity-related
2. Vein-type deposits in metamorphic rocks
3. Vein-type deposits in sediments

Figure 3. Stratigraphic distribution of uranium deposits by classification categories.

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Syngenetic deposits occur in five different types of sediments:

1. Placer deposits are described as modern fluvial and beach deposits. Fluvial placers develop in mountain streams and related ponds. If present, uranium is usually associated with thorium minerals, monazite and zircon, all of which are part of the heavy mineral suite in a poorly sorted matrix of fine to medium-grained gravels. The source of mineralization is a highland igneous complex. These deposits are small and almost exclusively limited to the peripheral limits of the Idaho Batholith district. There are no commercial uranium deposits associated with modern fluvial placers.

Beach deposits form along the ocean shorelines as well-sorted, fine-grained heavy mineral stringers interbedded with clean fine-grained quartz sand. Source and occurrence of mineralization is the same as for fluvial deposits. Modern placers exist off the coast of Egypt, Brazil, India and Florida, and fossil placers in the western USA also contain uranium. Beach deposits mined for rutile, monazite and zircon may yield small quantities of by-product uranium.

2. Quartz-pebble conglomerates are placer-type deposits that represent one of the principal resource categories. Known uranium-bearing quartz-pebble conglomerates of considerable economic importance are found in the Witwatersrand complex of South Africa, and in the Elliot Lake/Blind River district of Ontario, Canada. The conglomerate deposits differ from other sedimentary deposits in that they are limited to Lower Proterozoic strata and are in unconformable contact with Archean basement rocks. Further, they are highly pyritic, may be slightly metamorphosed, and contain detrital uranium minerals.

Uraninite and brannerite occur in the Ontario deposits, and uraninite occurs at Witwatersrand. Uranium is associated with a heavy mineral suite which includes important gold values at Witwatersrand, where uranium is produced as a co-product or by-product of gold. In both districts, the greatest concentration of minerals occur near the base of interbedded conglomoratic beds (known as *reefs* at Witwatersrand). The heavy minerals are finely disseminated throughout the favorable zone. A pattern of mineral distribution and segregation is apparent due to the density and size of the particles.

The source of the ore-bearing conglomerates is primarily fluvial. The uranium minerals have been present during the depositional sequence of the quartz-pebble matrix, forming into "orebodies" by the normal process of mechanical separation of the heavy minerals. Typically, the quartz-pebble conglomerates contain low values of uranium. The uranium content varies throughout each district, averaging about 0.10 percent U_3O_8 per ton in Ontario and 0.015 percent in Witwatersrand. Sub-economic uraniferous quartz-pebble conglomerates exist in Brazil and India.

3. Marine Black Shales occur in the stratigraphic section with siltstones, limestones and other shales of Paleozoic age. The black shales containing a high percentage of organic matter, pyrite (or marcasite) as thin stringers or nodules, or phosphate as thin nodules, are usually uraniferous. Contained uranium was probably extracted from seawater upon contact with each constituent during the depositional sequence. Usually, the uranium content averages less than 0.005 percent U_3O_8. However, uranium values show an increase as the content of organic material and phosphate nodules increase.

Uranium recovery from black shales has been performed only on an experimental basis, as opposed to a commercial basis. However, the shales often contain low-grade values of other metals, including copper, chromium, manganese, molybdenum, phosphorous, titanium, vanadium, and kerogen, a petroleum constituent. The recovery of other minerals as co-products is likely to be an important consideration in the economics of producing uranium from a black shale deposit.

Two black shale occurrences have been studied for commercial development of uranium and companion minerals. The Ranstad shale at Billingen, Sweden was considered during the mid-1970s, but the project was abandoned as uneconomic. The Geological Survey of Sweden estimated the vast shale deposit contains approximately 390,000 tons U_3O_8 at an average grade of 0.025 percent. The Chattenooga black shale deposit covers about 35,000 square miles of Tennessee, Kentucky and Alabama. The Gassaway Member of the deposit (upper 11 to 18 feet) contains the important mineral suite. The technology exists for the recovery of uranium, syncrude, ammonia and sulfur from the shale, but high costs preclude its development. Resource estimates for the study area indicate the presence of over 8 billion tons of mineralized shale.

4. Phosphorite consists primarily of the phosphatic mineral carbonate-fluorapatite, usually in the form of laminae, oolites and nodules. Uranium replaces the calcium in the carbonate-fluorapatite lattice. The oxidized portion of a phosphorite deposit, may have a uranium content of 0.005 to 0.020 percent; the grade tends to increase as phosphorite values increase. Uranium is recovered as a by-product to phosphoric acid in several operations located in Florida and one in Louisiana. Its recovery from developing phosphoric acid projects in Morocco and Israel is a possibility in the near future. Generally, phosphorite deposits worldwide have the same approximate uranium content, and they represent an extremely large potential source of low-grade uranium.

5. Seawater has low uranium values, measured at 3 to 10 parts per billion (ppb). The technology exists for the recovery

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of uranium from seawater, but it remains unrealistic considering present economic circumstances. (Nevertheless, Metal Mining Corporation of Japan has constructed an experimental plant to recover uranium from seawater. The model plant has the capacity to produce 10 kg of uranium per year.) However, certain groundwater sources and hot springs contain low-grade uranium that possibly could be recovered through ion-exchange techniques. Presently, uranium is recovered from mine waters using this method.

Epigenetic deposits occur in four sedimentary environments, including the resource base in sandstone formations. The remaining three types of occurrences are usually small and have only limited economic potential.

6. Lignite, coal and carbonaceous shales often contain uranium in low-grade quantities of about 0.005 to 0.01 percent, but in places the uranium content may approach 0.50 percent or higher. In the only attempt to recover uranium from such sediments, lignite was burned or retorted to drive off combustible carbonaceous material, leaving concentrated uranium in the ash. The uranium was eventually recovered from the ash by conventional methods. The source of contained uranium was precipitation and adsorption by the humates from uraniferous groundwater. The fact that the uranium is confined to a thin upper portion of the carbonaceous bed supports the theory of its origin.

No discrete uranium minerals have been identified, but secondary minerals such as meta-autunite and metatyuyamynite may occur in highly oxidized zones. Uraniferous coal sediments are limited primarily to the Fort Union Formation in the Williston Basin, North Dakota (where the lignite was burned) and the Wasatch Formation in the Red Desert of southern Wyoming.

7. Evaporative precipitates are usually classified as surficial uranium deposits, of which the calcrete deposits in Australia and Namibia are considered to be the most important resource. In each location, uranium weathered from granites was carried by surface or groundwater to a favorable host environment where evaporation and precipitation of uranium occurred. Mineralization is usually low in grade, averaging about 0.15 percent, with scattered zones of higher-grade material. Vanadium is usually a companion mineral to carnotite, the main uranium mineral. The age of calcrete deposits is late Tertiary.

Uranium mineralization that occurs in recent sediments (10,000 years ago and less), is so young that daughter products have not formed and radioactivity is nonexistent. Chemical analysis of samples is necessary to detect the presence of uranium. Overall, deposits in this classification represent a potential uranium resource, especially the Tertiary deposits which are well-defined and available for exploitation.

8. Limestone is host to only a few uranium deposits. The Todilto Limestone in the Grants Mineral Belt of New Mexico has been extensively mined in the past. It represents the largest resource base in that environment. The Todilto is fine-bedded with abundant vertical fractures associated with anticlinal structures. Uraniferous solutions entered fractures where uranium concentration occurred. The main uranium mineral is uraninite; secondary minerals of tyuyamunite and uranophane are common in shallow deposits. Mined deposits varied in size from several hundred tons to 50,000 tons or more, averaging 0.15 to 0.25 percent U_3O_8. The Todilto is essentially mined-out along the main mineral trend, but additional potential exists at greater depth.

Limestone uranium deposits have also been mined in the Bighorn and Pryor Mountains in Wyoming and Montana, and at Tyuya-Muyun, USSR. It occurs in filled caves, fissures, and solution channels. A small amount of uranium has also been mined from the limestone portion of the La Domitila deposit in Chihuahua, Mexico.

9. Sandstone is host to a variety of major uranium deposits scattered through several eras of geologic time. Sandstone host rock favorable to uranium deposits is generally of fluvial origin, consisting of medium to coarse-grained to conglomeritic quartz and arkosic material. Pyrite may be scattered throughout and concentrated along bedding planes, but the presence of mudstone lenses, thin stringers, and abundant organic debris are important constituents. Very few deposits occur in sandstones of marine origin.

Uranium accumulation occurs by precipitation from groundwater in a reducing environment. The mudstone and indurated sandstone layers form a barrier to the movement of highly oxidized mineral-bearing solutions. The organic matter and pyrite act as reducing agents, and hydrogen sulfide acts as one of the main reductants during uranium precipitation. It forms during the anaerobic destruction of organic matter and the oxidation of pyrite.

Uraninite and coffenite are the main uranium minerals present, and secondary minerals include carnotite, tyuyamunite, autunite and torbernite. The source of mineralization is uncertain, but could be from granitic rocks or tuffaceous sediments. In either scenario, uranium was leached from the source rock by migrating solutions. Hydrothermal solutions may have been the source of uranium in older deposits adjacent to prominent structural features.

Epigenetic sandstone deposits occur in three categories, each characteristic of the surrounding host environment. The

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three categories are stratiform, roll-type and vein-type deposits. (Vein-type deposits can occur in a wide variety of host rocks and genetic sources, so they are included in the last major classification section.) Stratiform deposits represent the largest uranium resource base in the USA. The deposits are tabular and usually elongated with the depositional trend of the formation. Stratiform deposits occur in the Chinle Formation of Triassic age in the Uravan Mineral Belt of Utah and Colorado, and in the Morrison Formation of Jurassic age in the Grants Mineral Belt, New Mexico. Important deposits also occur in the Wind River and Wasatch Formations of Tertiary-age in the basins of Wyoming.

Roll-type deposits occur in Tertiary channel sediments of the intermontane basins of Wyoming and coastal-plain environment of South Texas. Uranium deposition has occurred at the chemical boundary (solution front) between altered and unaltered zones within host sediments. A typical solution front forms as oxidizing solutions migrate and advance in a sinuous pattern through unaltered sediments. Uranium precipitates at the redox line to form C-, O- and S-shaped ore deposits. Roll-front mineralization may be associated with stratiform deposits, as in the Mount Taylor deposit of the Grants Mineral Belt.

B. Deposits in Plutonic Igneous Rocks

There are eight classes of uranium occurrence identified with *plutonic igneous rocks*. The classification system is somewhat theoretical because of a general lack of conclusive evidence regarding orthomagmatic stages (crystallization) of plutonic igneous rocks. Uranium concentration closely follows the process of magmatic evolution of the host rocks. Uranium is oxidized during the magmatic process and may be completely removed from the igneous environment, or concentrated during differentiation or recrystallization of the host material. Igneous rock characteristics, and the predicted behavior of uranium mineralization, can be segrated into identifiable criteria for field and laboratory evaluation.

1. Orthomagmatic occurrences are identified with regional tectonic deformation. Plutonic host rocks are highly granitic to syenitic, with a porphyritic texture. Metamorphism, accompanied by local metasomatism, may occur along contacts with intrusive dikes and zones where abrupt segregation of rock-forming constituents has occurred. Uranium-bearing minerals present include thorium, zircon and monazite. Primary uranium minerals are uncommon, but if present, uraninite will be the main mineral and coffinite occasionally will occur.

The Bokan Mountain deposit on the panhandle of Alaska may represent the largest deposit of this type. Uranium and uranium-bearing minerals are concentrated in the youngest of two intrusive magma series of Late Cretaceous age. The mineralization shows zonal dissemination within the granite. Several million pounds of U_3O_8 were mined during the late 1950s and early 1960s. A second location is along the Front Range of Colorado (near Central City), where a series of bostonite dikes intruded Precambrian metasedimentary rocks during Late Cretaceous time. Uranium mineralization occurs in association with zircon, thorite and allanite. The source of mineralization is thought to be hydrothermal solutions. The occurrence is small and probably lacks economic value.

2. Pegmatitic and aplitic uranium occurrences apparently form during the process of magmatic differentiation and segregation of pegmatitic fluids during the final stage of intrusion. Such occurrences show concentration along the margins of uranium-rich granitic masses, and in some cases, the dikes may intrude the country rock. Uraninite and the uranium-bearing minerals of uranothorianite, brannerite and allanite will be disseminated throughout the dike material. Zoning of mineralization in pegmatites is common, in which case concentrations of high-grade uranium may occur.

Bokan Mountain in Alaska is host to pegmatite and aplite dikes intruded into the Bokan Mountain granite. Allanite is the major uranium-bearing mineral present. Uraninite occurs in isolated zones of quartz segregation. Pegmatitic uranium is also common to the Bancroft area of Ontario. At the Bicroft mine, pegmatites were intruded into the Centre Lake granite where it makes contact with metasediments. Uranium is associated with the dikes in the form of uraninite, uranothorianite, allanite and betafite. Production has been initiated at several occurrences in the district.

3. Magmatic-hydrothermal uranium evolved from hydrothermal solution activity during the final stage of magmatic differentiation in a uranium-rich country rock. Shear and fracture zones associated with faulting are the host environment for the development of mineralized veins. The primary uranium minerals filling the veins are uraninite and pitchblende, with small amounts of coffinite and brannerite. Uranium deposits of this class occur at Radium Hill, Australia. Davidite is the primary uranium mineral present in fractures and shears confined to Archean and Lower Proterozoic metasediments.

4. Contact-metasomatic uranium occurrences have formed along shear and fracture zones associated with structural deformation at the contact between uranium-rich intrusive bodies and stable country rock. Uraniferous solutions present in late-stage hydrothermal activity, which may be in association with the intrusion of pegmatites, show uranium con-

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centration in veins and pods along the contact. Uranium enrichment into the country rock occurs through dissemination and metasomatism. The important uranium and uranium-bearing minerals are uraninite and thorianite.

The Mary Kathleen deposit located in Queensland, Australia is representative of this class. Uraninite mineralization shows metasomatic enrichment along the contact zone between calcareous metasediments and two intrusive granitic bodies. The main ore deposits are closely associated with faulting and brecciation in the metasediments. Almost 9,000 tons U_3O_8 have been mined and recovered from the Mary Kathleen deposit.

5. Autometasomatic uranium occurrences have formed from the interaction of late-stage hydrothermal solution activity upon previously crystallized plutonic rock. The solutions introduced along shears and faults brought in new uranium and caused remobilization of existing uranium to form enriched zones in-place or in adjacent environments. The mineral concentrations occur in fracture and breccia zones where albitized and chemically altered zones prevail.

This class deposit also exists at Bokan Mountain in Alaska, where uranium minerals are concentrated along graditional contacts with the host granites. The composition of the Kaffo Valley granite in Nigeria is similar to the Bokan Mountain granite. It also contains enriched uranium zones in albitized alteration, but those deposits have not been exploited.

6. Authigenic uranium occurrences are formed by the redistribution and concentration of uranium within the original igneous complex. Uranium minerals tend to concentrate along shears and fractures where rock alteration is more pronounced. The concentration of uranium is related to the degree of rock alteration and intensity of weathering. The downward extent of the mineralization is apparently related to groundwater levels. Autunite is the main uranium mineral present.

The Daybreak mine located on Mount Spokane, Washington falls under the authigenic class. Uranium has accumulated along a horizontal shear zone in a host of porphyritic quartz monzonite intruded at different locations by biotite pegmatites. Vertical shears confined to the upper portion (hanging wall) of the main zone are also mineralized. The main uranium mineral is meta-autunite. The deposit has been extensively mined.

7. Allogenic uranium occurrences formed as a result of remobilized uranium being transported away from source rocks and reconcentrated in a new environment. The new accumulations are usually limited to highly fractured and brecciated rock. Pitchblende is the primary uranium mineral present; uranophane may be present as a secondary mineral.

The Midnight mine located 40 miles northeast of Spokane, Washington is considered an allogenic deposit. The uranium is concentrated in a number of step faults and shears in metasediments covering a portion of a quartz monzonite intrusion. Pitchblende and uranophane are common to the deposit; autunite occurs in highly altered rock on the surface. The Nabarlek deposit in the Northwest Territory, Australia is another example of allogenic uranium. Pitchblende is associated with disseminated sulfides and hematite throughout a shear zone in structurally deformed and metasomatized Precambrian schists. Uranium content shows zoning with the highest grades associated with the hematite. The deposit yielded 12,000 tons of U_3O_8 at an average grade of 2.34 percent.

8. Anatectic uranium deposits are restricted to a particular suite of granitic rocks whose origin may be igneous and metamorphic. Pegmatites, aplites and alaskites are considered of anatectic origin in an enclosing environment of metasediments. Uranium-bearing solutions affect the concentration of primary uraninite and uranothorite into tabular and lens-shaped bodies that conform to rock foliation and structural features. Steep isoclinal folding is characteristic of the host environment.

The Rossing deposit located in Namibia is confined to complex folding in anatectic alaskites emplaced along shears, fractures and bedding planes of metasedimentary and metavolcanic schists and gneisses, which make up the Khan and Rossing Formations. Uraninite is well disseminated throughout the alaskite, and secondary uranium occurs in both the alaskite and metasediments. The deposit is currently being mined.

C. Volcanogenic Uranium Deposits

Uranium in volcanogenic rocks is classified according to four ore-forming processes which can develop during phased stages of volcanogenesis. Each relates to a geologic setting identified as favorable for hosting uranium mineralization. The genesis of caldera structures is considered a primary uranium-concentrating mechanism for volcanogenic deposits. The most important volcanogenic uranium deposits are directly related to such structures which formed during the Tertiary Period. Uranium is syngenetic to the volcanic process; it is a constituent in volcanic source rock, associated gases, and in trapped or migrating fluids. Concentrating mechanisms relate to changes in temperatures and pressures affecting the magma. The four ore-forming processes represent different stages of caldera volcanism relative to the development of ring fractures, initial surface eruptions, caldera collapse, cauldron-basin

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sedimentation, resurgence of volcanism, resurgent doming, and the final stage of volcanism associated with old and new ring fractures.

1. Initial-magmatic uranium occurs as disseminations of uranium and uranium-bearing minerals during the liquid phase of deep-seated magmas. The mixing of magmas and hydrothermal fluids concentrates the uranium, thus providing the source of mineralization. The continued migration of magma and subsequent cauldron-forming processes provide the environment for accumulation of uranium (extremely fine-grained uraninite). Uranium deposition occurs during crystallization of the magmas. The uranium may become further concentrated through the process of remobilization during a later phase of volcanogenesis (caldera collapse or domal resurgence). Deposits in the Sierra Pena Blanca district, located in Chihuahua, Mexico, are in this class.

2. Pneumatogenic uranium deposits develop from uranium-rich gases emanating from magma during late stages of caldera development. The gases continue to emanate from the magma during periods of surface eruption and the wide distribution of ash-flow tuffs. Uranium tends to concentrate in veins and breccia-collapse zones formed in the intrusive or extrusive magmas and ash flows during the period of abrupt changes in temperature and pressure. Pitchblende is the main uranium mineral present, usually forming in low-grade concentrations of questionable economic value. However, ore grades of about 0.20 percent U_3O_8 have been encountered in deposits of Mexico's Sierra Pena Blanca district.

3. Hydroauthigenic uranium occurrences developed from a source of highly siliceous uranium-rich fluids. The fluids were condensed from volcanic gases generated during the eruptive phase of caldera development. The gases were trapped in voids and pore-space of ash flows. Concentration of uranium results from magma cooling and depressurization. The uranium mineral is uranophane, a calcium-rich uranosilicate. Uranium deposits of this class occur in the Sierra Pena Blanca district of Mexico and at the Mammoth Prospect, Presido County, Texas. At Mammoth, uranophane occurs in cavities in welded bands of the Buckshot Ignimbrite. The deposit is small and has not been exploited.

4. Hydroallogenic occurrences consist of epigenetic uranium formed in country rock environments adjacent to the volcanic system. Uranium, in the form of uranosilicate, originates from entrapped fluids released during internal movement of magmas and surface eruptions. The redistribution of syngenetic uranium by ground-water migration may contribute to the concentrating process during late-stage cauldron development. Uranophane is the main uranium mineral present. Uranium occurrences in this class are found in the Sierra Pena Blanca district of Mexico, the Virgin Valley of Nevada, and at the Spancevo deposit in northeastern Yugoslavia.

D. Uranium Deposits of Uncertain Genesis

There are three types of uranium occurrences in this classification — Unconformity-related deposits, vein-type deposits in metamorphic rocks, and vein-type deposits in sedimentary rocks. Unconformity-related deposits represent some of the largest and highest-grade deposits discovered to date. The uncertainty of ore genesis is the only common characteristic in the three classes. In question are the source of uranium and uranium-bearing solutions, mode of transportation, lithologic and structural controls, and the role of reductants. Each aspect is important to uranium concentration processes.

Uranium contained in deposits of this classification is epigenetic, and is available from multiple sources. Uranium leached from older granitic rocks is probably the main source. Most granitic rocks contain 3 to 5 parts per million (ppm) uranium; some contain up to 100 ppm. Uranium in granites is readily leachable during the movement of oxidizing solutions. Traces of uranium in sedimentary rocks are common, especially in the dark shales. The wide spread movement of oxidizing solutions through sediments is the initial phase for the leaching process — uranium becomes highly mobile in an oxidizing environment. The third source of uranium is hydrothermal solutions associated with metamorphism. Deep-seated solutions are carriers of uranium-bearing minerals which tend to mobilize and concentrate during the metamorphic process.

An oxidizing environment is required to mobilize the uranium, and a reducing environment is necessary to precipitate the uranium. The presence of a few common reductants such as ferrous-iron, sulfides, graphite and carbon indicate a reducing process. Uranium-bearing solutions making contact with any reductants in a favorable host will start the precipitation process. Fracturing, faulting and brecciation represent favorable host conditions.

1. Unconformity-related uranium deposits are confined to the major unconformity sequence separating Precambrian shield rocks from overlying Lower Proterozoic metasediments. Wide-spread structural deformation and metamorphism is established in the basement rock. However, locally controlled vein systems associated with fracturing, faulting and brecciation, in addition to intense weathering, becomes the sites for major uranium concentrations. Structural features originated at depth in the basement rock and usually extend upward for some distance into the metasediments. Likewise, mineralization may follow the favorable structural (and alteration) environment above and below the unconformity. Graphite schists are usually closely associated with uranium accumulations. Pitchblende and coffinite are the main uranium minerals present, forming large-tonnage ore deposits that may average about 2.50 percent U_3O_8, but often containing values that commonly exceed 50 percent U_3O_8. The mineralizing process is dated at 2,000 to 1,600 million years old, while the age of the host formations is estimated at 2,500 to 2,200 million years.

Important uranium deposits in this class include the majority of deposits located in the Athabasca Basin of northern Saskatchewan. Specifically, uranium in the Cluff Lake deposit and the deposits along the Key Lake/Rabbit Lake trend is primarily, but not exclusively, concentrated in the regolith zone at the unconformity. Uranium in the Cigar Lake deposit to the northwest of the trend is largely confined to the Athabasca Quartzite above the unconformity.

The Jabiluka deposit, located in the East Alligator River district in Australia's Northern Territory, is an unconformity-related uranium deposit. Uranium has concentrated in chlorite muscovite-rich metasediments at the unconformity between Lower and Middle Proterozoic units. The ore zone extends downward into the Lower Proterozoic Cahill Formation. The Ranger deposit, which is located about 20 km south of Jabiluka, occurs in a similar environment with relation to the unconformity.

2. Vein-type uranium deposits in metamorphic rocks usually form in secondary structural features including fractures, faulting and brecciation. The uranium is introduced into the vein system by hydrothermal solutions accompanying metamorphism. Pitchblende is the main uranium mineral precipitated in the veins and as finely disseminated particles in the vein host rock. A vein system usually follows the favorable structural features to considerable depth, creating the potential for a large-tonnage ore deposit.

Deposits in the Beaverlodge area of Northern Saskatchewan are metamorphic vein-type. The uranium-bearing veins are concentrated in highly foliated and brecciated rocks of Lower Proterozoic age. Pitchblende mineralization formed large, high-grade deposits associated with the pattern of foliation.

3. Vein-type uranium deposits in sediments make up the third category. Vein-type deposits cut across the normal pattern of sedimentation at angles from almost horizontal to vertical. Uranium fills veins in fractures, breccia zones, and faults associated with deformation of sediments. The source of mineralization in vein-type deposits is uncertain. It may have been introduced through migrating (ascending mineral-rich brines or descending mineral-rich groundwater) solutions in a brecciated or fractured host, and possibly as second-stage mineralization resulting from supergene enrichment-type and remobilization of uranium as in stratiform deposits.

The common example of vein-type deposits are the breccia pipes found throughout northern Arizona. In a pipe, the zone of brecciation penetrates sediments from Mississippian limestone up through Triassic sand units. Mineralization of the breccia zone is estimated to have occurred during late Triassic and possibly early Jurassic time. Abundant pyrite and organic material present in the upper formations served as reducing agents that stimulated uranium precipitation. The main uranium mineral present is uraninite occurring in association with various sulfide minerals such as sphalerite, galena, chalcopyrite and molybdenite.[3] Several deposits in breccia pipes presently are being mined.

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[3] See "Mineralization of Breccia Pipes in Northern Arizona," by K. J. Wenrich, Economic Geology, Vol. 80, 1985, pp. 1722-1735.

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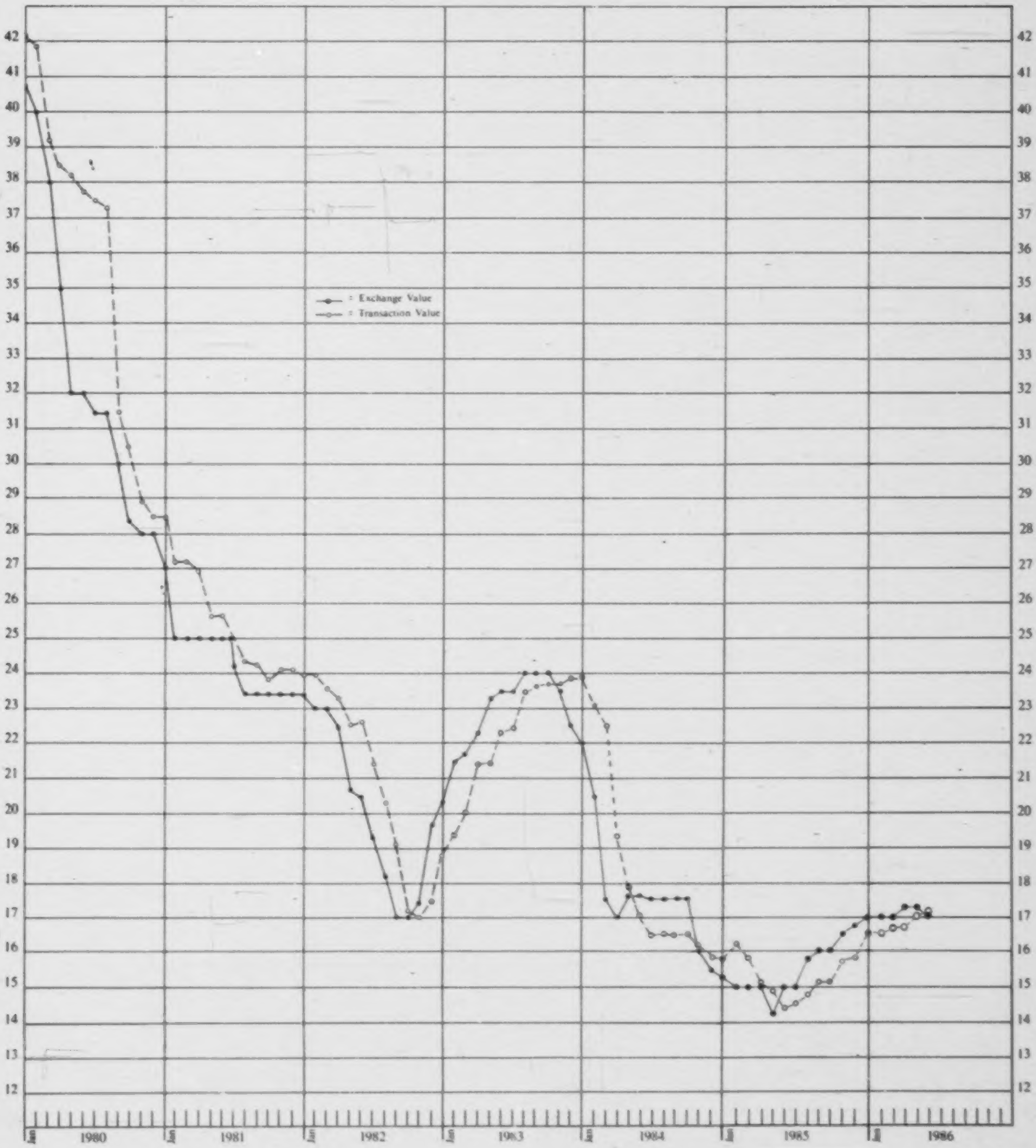
HISTORICAL MARKET DATA

EXCHANGE AND TRANSACTION VALUES SINCE JANUARY 1980

Determined as of the last day of the month indicated



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HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	32.50	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	**17.00**							

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	**17.15**							

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U in UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.80	1.90	**1.80**							

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GOVERNMENT STATISTICS

AUSTRALIA

	Price Index of Materials Used in Manufacturing Industry — All Groups[1] (1984 = 100)	**Award Rates of Pay Indexes Australia — Adult Males In Mining Wage Earners, Weekly Rates[2] (1976 = 100)**
1975 Avg.	150.4	132.6
1976 Avg.	168.4	160.9
1977 Avg.	192.0	179.0
1978 Avg.[3][4]	198.5	190.0
1979 Avg.	248.8	127.9
1980 Avg.	321.8	140.8
1981 Avg.	355.3	154.1
1982 Avg.[5]	368.6	174.9
1983 Avg.	401.6	181.8
FY84 Avg.[6]	95.3	—
FY85 Avg.[6]	100.0	—
Jan 1985	97.0	197.8
Feb 1985	98.6	197.8
Mar 1985	102.1	197.8
Apr 1985	104.4	202.8
May 1985	107.6	202.8
Jun 1985	108.7	202.8
Jul 1985	111.1R	202.8
Aug 1985	110.5	202.8
Sep 1985	108.9	202.8
Oct 1985	108.7R	202.8
Nov 1985	109.6	210.2
Dec 1985	110.2	210.3
Jan 1986	109.8P	210.3
Feb 1986	109.1P	210.3
Mar 1986	—	210.3

P = Preliminary R = Revised since last month

[1] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0). The basis of this index was revised to 1984 = 100. The previous index was 1969 = 100.

[2] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

[3] Monthly data for 1970-78 appear on pages 4.7 and 4.8 of Report 138.

[4] Annual averages prior to 1979 reflect index base no longer in use.

[5] Monthly data for 1979-82 appear on page 35 of Report 184.

[6] Annual averages are for financial year ending June 30.

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CANADA

	Industry Selling Price Index: All Commodities[1] (1981 = 100)	Wage-earner Data: Average Hourly Earnings (C$)[2]					
		Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells[3] (SIC 051-099)	Primary Non-ferrous Metal Industries[4] (SIC 296)	Primary Non-ferrous Metal Industries[4] (SIC 298)	Chemicals and Chemical Products[5] (SIC 372-379)
1979 Avg.[6]	217.9	—	9.60	9.66	—	—	7.67
1980 Avg.	247.2	—	10.58	10.80	—	—	8.50
1981 Avg.	288.7	—	12.02	12.23	—	—	9.53
1982 Avg.[7]	288.8	—	13.74	13.92	—	—	10.63
1983 Avg.	298.8	—	—	14.30	—	—	11.17
1984 Avg.	310.9	17.88	—	15.07	12.28	10.49	11.76
Jan 1985	117.5	18.05	16.13	15.60	12.32	10.80	12.04
Feb 1985	117.7	18.78	16.41	15.68	12.52	11.05	12.06
Mar 1985	118.4	18.24	16.21	15.57	12.44	10.97	12.02
Apr 1985	118.3	18.63	16.44	15.80	12.81	11.23	12.04
May 1985	118.6	19.41	16.51	15.63	12.76	11.25	12.15
Jun 1985	118.6	18.49	16.20	15.49	12.89	11.14	12.14
Jul 1985	118.6	18.14	16.27	15.41	12.96	11.17	12.13
Aug 1985	118.4	17.07	16.03	15.30	12.97	11.31	12.19
Sep 1985	118.6	18.53	16.55	15.72	12.95	11.39	12.26
Oct 1985	118.9	18.74	16.51	15.70	13.14	11.53	12.33
Nov 1985	119.1R	19.05	16.66	15.88	12.76	11.32	12.49
Dec 1985	119.7R	19.07	16.57	16.01	12.51	11.09	12.59
Jan 1986	120.6R	18.15	16.22R	15.86	13.11R	11.48R	12.52R
Feb 1986	120.5	19.52R	16.57R	15.99R	13.20R	11.59R	12.45R
Mar 1986	120.0	19.04P	16.22P	15.89P	13.15P	11.63P	12.59P

P = Preliminary R = Revised since last month

[1] Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Index prior to 1985, 1971 = 100.

[2] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours" (Catalogue 72-002).

[3] Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

[4] Beginning with the April 1983 figure, Primary Metal Industries, non-ferrous is split into SIC 296 and SIC 298.

[5] Chemical and Chemical Products prior to April 1983 was SIC 370-379. The new series is from a new survey which includes all companies and is based on a 1970 classification. The old survey only included companies of 20 employees or more.

[6] Monthly ISPI for 1977 and 1978 appear on page 4.10 of Report 138, and monthly wage-earner data for 1973-78 appear on page 4.11 of Report 138.

[7] Monthly data for 1979-1982 appear on page 37 of Report 184. On that page, the wage earner index entitled "Metal Mining, Including Milling (SIC 050-099)" should read "Total Mining (SIC 051-099)."

[8] Beginning with the March 1983 figure, Wage Earner Data are based on a census of all companies employing 200 or more wage earners, *plus* a random survey of companies employing fewer than 200 wage earners. Prior to March 1983 only companies employing 200 or more wage earners are included in the Wage Earner Data.

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GOVERNMENT STATISTICS

REPUBLIC OF SOUTH AFRICA

		Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1]	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100)[2]	Consumer Price Index[3] (1980 = 100)[4]	Producer Price Index All Groups[5] (1980 = 100)	Total Employment in Mining and Quarrying (Code 35)[6]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[6]
1975	Avg.	16.71	—	157.2	100.0	639,473	1,003,617
1976	Avg.	19.30	—	174.7	115.1	671,240	1,212,983
1977	Avg.	23.87	—	194.4	130.0	712,006	1,420,670
1978	Avg.	27.14	—	137.2	142.7	664,571	1,537,169
1979	Avg.[7]	30.18	—	155.3	164.5	692,209	1,830,632
1980	Avg.[8]	35.53	—	176.7	192.1	714,379	2,279,615
1981	Avg.	41.89	—	206.5	218.3	728,506	2,820,505
1982	Avg.[9]	47.25	104.2	233.5	248.7	707,552	3,246,071
1983	Avg.	51.87	115.0	262.2	274.8	696,579	3,644,772
Jan	1984	—	—	274.7	283.3	689,807	326,619
Feb	1984	—	—	278.4	286.5	702,553	335,906
Mar	1984	55.30	123.1	281.9	288.0	715,628	342,332
Apr	1984	—	—	286.1	290.2	712,963	327,550
May	1984	—	—	288.3	292.6	710,040	327,937
Jun	1984	56.95	126.2	291.2	295.3	717,009	347,121
Jul	1984	—	—	295.1	296.0	717,121	369,964
Aug	1984	—	—	297.0	300.8	721,905	361,357
Sep	1984	60.64	133.2	299.9	304.1	721,470	359,218
Oct	1984	—	—	303.7	308.7	717,865	363,755
Nov	1984	—	—	307.4	312.8	717,396	369,771
Dec	1984	62.92	138.6	309.4	315.9	701,198	365,234
Jan	1985	—	—	177.1	166.6	711,366	376,777
Feb	1985	—	—	182.8	171.3	727,932	361,823
Mar	1985	64.48	142.4	183.6	173.0	708,809	371,380
Apr	1985	—	—	187.4	174.0	724,187	369,005
May	1985	—	—	189.5	177.7	708,085	373,478
Jun	1985	67.42	148.9	191.9	179.2	724,587	395,543
Jul	1985	—	—	193.6	180.7	738,228	419,106
Aug	1985	—	—	195.6	183.2	734,121	416,777
Sep	1985	70.47	155.3	197.8	184.8	732,836	419,883
Oct	1985	—	—	200.8	188.1	720,071	401,448
Nov	1985	—	—	203.4	196.0	750,049	432,996
Dec	1985	72.43	160.1	207.4	199.4	741,372	425,261
Jan	1986	—	—	213.8	203.6	744,070	—
Feb	1986	—	—	215.8	206.9	752,500	—
Mar	1986	75.76	167.8	218.3	206.9	758,884	—
Apr	1986	—	—	222.2	—	—	—

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[1] Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly.

[2] Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

[3] Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."

[4] The basis for calculation prior to January 1985, 1975 = 100. For annual averages prior to 1978, April 1970 = 100.

[5] Previously known as the Wholesale Price Index, now the Producer Price Index. The computation remains the same. The basis for calculation prior to January 1985, 1975 = 100.

[6] Bulletin of Statistics, Department of Statistics, Pretoria.

[7] Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 4.9 of Report 140.

[8] Monthly data for Codes 35 and 40, 1977-1980, appear on page 28 of Report 157.

[9] Monthly data for 1979-82 appear on page 39 of Report 184.

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UNITED STATES

	Producer Price Index[1]		Consumer Price Index[2] (1967 = 100)	GNP Implicit Price Deflator[3,4] (1982 = 100)	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[5]			
	Industrial Commodities (1967 = 100)	All Commodities (1967 = 100)			Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980 Avg.[6]	274.8	268.8	246.8	178.64	10.26	10.63	8.30	6.94
1981 Avg.	304.1	293.4	272.4	195.51	11.55	11.98	9.12	7.62
1982 Avg.[7]	312.3	299.3	289.1	207.15	12.33	12.94	9.96	8.21
1983 Avg.	315.8	303.1	298.4	215.63	12.57	13.43	10.59	8.65
1984 Avg.	322.6	310.3	311.1	108.1	13.05	13.43	11.08	9.04
Jan 1985	322.9	309.5	316.1	—	13.29	13.70	11.39	9.33
Feb 1985	322.5	309.2	317.4	—	13.30	13.73	11.39	9.33
Mar 1985	322.6	308.7	318.8	110.4	13.29	13.95	11.37	9.39
Apr 1985	323.8	309.3	320.1	—	13.43	13.62	11.48	9.40
May 1985	325.3	309.8	321.3	—	13.24	13.59	11.46	9.39
Jun 1985	324.8	309.2	322.3	111.3	13.23	13.66	11.52	9.46
Jul 1985	324.4	309.0	322.8	—	13.45	13.82	11.60	9.47
Aug 1985	323.7	307.3	323.5	—	13.55	13.69	11.62	9.50
Sep 1985	322.3	305.5	324.5	112.1	13.44	13.66	11.67	9.55
Oct 1985	324.2	307.9	325.5	—	13.49	13.64	11.72	9.56
Nov 1985	324.7	309.5	326.6	—	13.49	13.95	11.82	9.61
Dec 1985	325.1R	310.2	327.4	113.0	13.43	13.78	11.87	9.68
Jan 1986	324.0	309.0	328.4	—	13.40	13.67	11.87	9.61
Feb 1986	319.4	304.7	327.5	—	13.44R	13.79R	11.83R	9.60R
Mar 1986	314.0	300.3	326.0	113.7	13.24P	13.90P	11.79P	9.63P
Apr 1986	311.3	297.9	325.3	—	—	—	11.82P	9.63P

P = Preliminary R = Revised since last month

[1] US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

[2] US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items.

[3] US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

[4] The basis for calculation of this index was revised to 1982 = 100. 1984 and 1985 figures have been adjusted to that basis. The basis for calculation prior to 1984, 1972 = 100.

[5] US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for 1977-1978 are adjusted to the March 1979 benchmark. Data for January 1979 and beyond are adjusted to the March 1980 benchmark.

[6] Monthly data 1970-1978 for Producer Price Index-Industrial Commodities, Consumer Price Index, and Employment and Earnings SIC codes 10, 333, and 28, and quarterly data for GNP Implicit Price Deflator appear on pages 4.6-4.8 of Report 139.
Monthly data 1977-1978 for Employment and Earnings SIC Codes 10, 333, and 28 appear on page 33 of Report 147.
Monthly data 1970-1978 for Employment and Earnings SIC Code 36 appear on page 23 of Report 154.
Monthly data 1977-1980 for Producer Price Index-All Commodities, appear on page 21 of Nuexco Report 158.

[7] Monthly data 1979-1982 for all listed indices appear on page 41 of Report 184.

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REPRESENTATIVES AND CONSULTANTS

AUSTRALIA

Peter Stork
Oratom Consulting
5 Gould Ave.
St. Ives
NSW 2075, Australia
Telephone: (61-2) 449-6783
Telex: AA123976 (COMTLX)

JAPAN

Kazy Yokota
Japan Tech Services
Ohkura Building (3F)
1-4-10 Shiba Daimon
Minato-ku, Tokyo, Japan
Telephone: (81-3) 431-6031, 6025
Telecopy: (81-3) 434-6674
Telex: 242-5060-(JATECH J)

SOUTH AFRICA

Chris I. Von Christierson
Southern Prospecting (Pty) Limited
P.O. Box 61409
Marshalltown 2107
Republic of South Africa
Street Address:
10th Floor
Eagle Star House
70 Fox Street
Johannesburg 2001
Telephone: (27-11) 838-1868
(27-11) 834-4211
Telecopy: (27-11) 834-3148
Telex: 4-89878 SA

TAIWAN

Edward Bee
Bee & Liang Company, Ltd.
14 FL Universal Business Center
NO. 663, Tun Hwa South Road
P.O. Box 1396
Taipei, Taiwan R.O.C.
Telephone: (886-2) 704-9630
TWX: 785-11570 (BEELIANG)

UNITED STATES

Harold C. Lindberg
83-A Hardee Lane
Whispering Pines, N.C. 28327
Telephone: (919) 949-3622

M. Jerry Reaves
Suite 500
Seven Piedmont Center
Atlanta, Georgia 30305
Telephone: (404) 262-7375

Ralph O. Smith
141 Braemar Drive
Cheshire, Connecticut 06410
Telephone: (203) 272-6246

SPECIAL CONSULTANTS

George J. Stathakis
International Investment Banking

James C. C. Stewart
U.K. Nuclear Industry

Claus C. Thiesen
Japan Nuclear Industry

W. Bryan Webster
International Business Development

J. Robert Wolcott
International Business Development

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NUEXCO REPORT 214 FIGURES OF THE MONTH (May 31, 1986)	This Month (Report 214)	Last Month (Report 213)	12 Months Ago (Report 202)
Exchange Value[1]	17.00	17.25	15.00
Transaction Value[1]	17.15	17.10	14.45
UF_6 Value[2]	48.25	48.50	42.50
Loan Rate[3]	4%	5%	5%
Conversion Value[4]	1.80	1.90	1.50
Near-Term Uranium Supply[5]	4.2	2.6	2.7
Near-Term Uranium Demand[6]	1.0	1.2	1.0
Near-Term Supply-Demand Ratio	4.3	2.1	2.8
Recent Uranium Sales:			
Number of Transactions[7]	6	6	8
Quantity of Material[8]	1.2	1.4	3.5
Nuexco SWU Value:[9]			
at 0.3 tails assay and delivery within one year	75	80	—
USDOE SWU Prices:			
USEC	125.00[10]	125.00[10]	135.00
AFC	153.00[11]	153.00[11]	153.00[11]
Requirements	157.00[11]	157.00[11]	157.00[11]
Market Value of Enriched UF_6[12,13]:			
2.5 w/o U_{235}	450	467	456
3.0 w/o U_{235}	575	598	587
3.5 w/o U_{235}	702	731	721
4.0 w/o U_{235}	831	866	857

---

[1] US $ per pound U_3O_8 equivalent.

[2] US $ per kilogram U as UF_6.

[3] Per annum.

[4] US $ per pound U as UF_6.

[5] Active inquiries to sell, for delivery within 12 months after contract signing (millions of pounds U_3O_8).

[6] Active inquiries to purchase, for delivery within 12 months after contract signing (millions of pounds U_3O_8).

[7] Uranium sales only; does not include loans, conversion, or SWU transactions.

[8] Millions of pounds U_3O_8, equivalent.

[9] US $ per SWU.

[10] Effective 10/1/85.

[11] Effective 10/1/84.

[12] Calculated using the Nuexco Exchange Value, Conversion Value, and 0.30 percent tails assay. From 4/30/85 to 11/30/85, calculations used in the Nuexco SWU Value for DOE origin and delivery by the end of FY86. As of 12/31/85, calculations use the SWU Value for delivery within one year.

[13] US $ per KgU as UF_6, rounded to the nearest $.

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EXECUTIVE SUMMARY
REPORT 214
(All data as of May 31, 1986)

Exchange Value **$17.00, down $0.25**	The **Exchange Value** is **$17.00** per pound U_3O_8, down $0.25 since last month.
UF_6 Value **$48.25, down $0.25**	The **UF_6 Value** is **$48.25** per kilogram U as UF_6, down $0.25 since last month.
Transactions	Six recent natural uranium sales are reported, involving approximately 1.2 million pounds equivalent U_3O_8 in the near term. Five of the sales involved spot or near-term delivery and three met the conditions for inclusion in the Transaction Value. Two transactions involved natural UF_6.
Supply-Demand Ratio **rose to 4.3:1**	Active spot and near-term **uranium supply** amounts to **4.2 million** pounds U_3O_8 equivalent, up 1.6 million pounds since last month. Active spot and near-term **uranium demand** totals **975 thousand** pounds, down 250 thousand pounds. The spot and near-term **supply-demand ratio** rose to **4.3:1.**
Transaction Value **$17.15, up $0.05**	The **Transaction Value** is **$17.15** per pound U_3O_8, up $0.05 since last month. The calculation includes 13 transactions involving a total of 2.1 million pounds U_3O_8 and equivalent UF_6, and covers a period of 4 months.
Loan Rate **declined to 4%**	The **Loan Rate** is **4 percent** per annum, down one percent.
Conversion Value **$1.80, down $0.10**	The **Conversion Value** is **$1.80** per pound U as UF_6, down $0.10 since last month. Active secondary market supply for conversion services for delivery within three years totals 1.7 million pounds U as UF_6. Active demand totals 565 thousand pounds U as UF_6. Three secondary market conversion transactions are reported.
SWU Value for **delivery within** **one year: $75**	The **SWU Value** at .3 tails and for delivery within one year is **$75** per SWU, down $5 since last month. No secondary market SWU transactions are reported.

* * *

Focus	Niger's uranium operations produced 8.3 million pounds U_3O_8 in 1985, but further reductions at Somair's Arlit mine could cause Niger's output to decline to slightly more than five million pounds annually after 1990.
Australia	Pioneer Concrete Services Limited's bid to purchase North Broken Hill's 31-percent share of Energy Resources of Australia (ERA) has been called off. If the deal had been approved, Pioneer would have owned significant interest in both of Australia's active uranium producers.
Netherlands	The pro-nuclear Christian Democrat coalition government of Prime Minister Ruud Lubbers unexpectedly retained its majority in parliamentary elections, thereby preserving the possibility that two additional nuclear units will be built. Earlier polls had predicted that Lubbers' coalition would lose to the Labor Party, which advocates the abandonment of nuclear power in the Netherlands.
United States	A proposed revision to statutes pertaining to accounting standards for utilities having nuclear plants will be the subject of a standards board hearing in early June. At issue is the manner in which costs associated with building the plant, including disallowances and plant cancellations, are handled for accounting purposes.
Raw Materials	This article describing the various classifications of uranium deposits worldwide may serve as a useful reference guide.

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JULY 1986 NUMBER 215

MONTHLY REPORT

ON THE NUCLEAR FUEL MARKET

NUEXCO

HEADQUARTERS

Three Park Central
1515 Arapahoe Street
Suite 1045
Denver, Colorado 80202
Telephone: (303) 893-4015
Telecopy: (303) 825-4821
Telex: 450202 (NUEXCO DVR)

Chairman of the Board of Partners
Oren L. Benton

Vice Chairman of the Board of Partners
Samuel R. Freeman

EASTERN UNITED STATES

100 Prospect Street
Century Plaza South
Stamford, Connecticut 06901
Telephone: (203) 323-1999
Telecopy: (203) 325-1483
Telex: 4750124 (NUEXCO C)

Managing Broker
Earl E. Hoellen, Jr.

WESTERN UNITED STATES

Building 3, Suite 290
3000 Sand Hill Road
Menlo Park, California 94025
Telephone: (415) 854-1510
Telecopy: (415) 854-2115
Telex: 470674 (NUEXCO UI)

Managing Broker
George White, Jr.

EUROPE

13 chemin du Levant
01210 Ferney-Voltaire
France
Telephone: (33-50) 428035
Telecopy: (33-50) 428526
Telex: 385288 (NUEXCO F)

Managing Broker
James E. Vaughan

REGIONAL MANAGING BROKERS

AFRICA
James E. Vaughan

AUSTRALIA
George White, Jr.

CANADA
Wayne D. Fowler
(303) 893-4015

FAR EAST
Christian C. Guitton
(415) 854-1510

MEXICO AND SOUTH AMERICA
Earl E. Hoellen, Jr.

(See inside back cover for list of Representatives and Consultants)

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MONTHLY REPORT ON THE NUCLEAR FUEL MARKET

July 1986 No. 215

GEORGE WHITE, JR., *EDITOR* CLARK M. BEYER, *ASSOCIATE EDITOR*

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To Our Readers

Nuexco is pleased to announce that **Mr. Donald P. Ebright** will again be associated with Nuexco effective August 1, 1986. Mr. Ebright worked extensively with Nuexco prior to 1982 as an overseas representative. Mr. Ebright will become a Vice-President with Concord-Nuexco International Corporation, a parent corporation to Nuexco, and will be involved in a broad range of activities for that company as well as for Nuexco. He will be based in Zurich, Switzerland, and from such Concord-Nuexco office will augment Nuexco's Ferney-Voltaire office in its European operations. Mr. Ebright was employed at General Electric in marketing responsibilities for 27 years in the United States, the Far East and Europe prior to 1974, and has resided in Europe for the last 18 years. Mr. Ebright brings to Nuexco a great deal of experience in the nuclear industry. He can be reached at the following address:

Don Ebright
Transcommerce International AG
135 Zürichstrasse
CH-8700 Kusnacht, Switzerland
Telephone: (41-01) 910-8977
Telecopy: (41-01) 910-6672
Telex: 58877 (COMAG)

* * *

We would also like to announce that **Mr. Fredrick J. Boyne** has assumed the position of Vice President and General Counsel of Nuexco. Mr. Boyne was previously with Getty Oil Company for 24 years and most recently served that firm as Associate General Counsel. He received his Juris Doctor from the University of Minnesota. Mr. Boyne's extensive experience in natural resources, including uranium mining, as well as his broad experience in a number of other businesses will serve Nuexco and other business activities of Nuexco's parent entity, Concord-Nuexco International Corporation.

* * *

Oratom Consulting Pty. Ltd., Nuexco's representative in Australia for the past six years, ceased its operations on June 30, 1986. Peter Stork, Oratom's principal, who was formerly associated with both Queensland Mines Ltd. and Pancontinental Mining Ltd., has become associated with and will lead the Australian branch of a worldwide Christian organization. We join Peter's many friends in the industry in wishing him well in the future.

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PRICING

NATURAL URANIUM AND SECONDARY MARKET CONVERSION

(All data as of June 30, 1986)

The **Exchange Value** is **$17.00** per pound U_3O_8, unchanged since last month. **Active supply** of natural uranium (concentrates and UF_6) for spot or near-term delivery totals **4,050,000** pounds U_3O_8 equivalent, down 165 thousand pounds since last month. The corresponding figure for **active demand** is **2,050,000** pounds, up 1.1 million pounds. The spot and near-term **supply-demand ratio** fell to **2.0:1.**

The *Current Market Data* section of this Report lists four natural uranium sales, involving approximately 600 thousand pounds equivalent U_3O_8. All of the transactions involved natural UF_6 for near-term delivery, and all met the criteria for inclusion in the current Transaction Value calculation.

The **Transaction Value** is **$17.20** per pound U_3O_8, up $0.05 since last month. The calculation extends over a 3-month period and includes 14 transactions involving 2.2 million pounds equivalent U_3O_8.

The **UF_6 Value** is **$48.25** per kilogram U in UF_6, unchanged since last month.

The **Conversion Value** is **$1.80** per pound U in UF_6, unchanged since last month. Active supply of secondary market conversion services for delivery within three years totals 1.7 million pounds U as UF_6. Active demand totals 565 thousand pounds U as UF_6. No secondary market conversion transactions are reported.

The **Loan Rate** is **4 percent** per annum, unchanged.

* * *

The Exchange and UF_6 Values were unchanged as of the end of June. Several lots of natural uranium remained available for sale around the $17.00 per pound U_3O_8 level, and several transactions were completed or in negotiation as of the end of the month. In recent months there has been consistent buying activity (for generally moderate quantities) in the uranium market, and the amount of material available at spot price levels has exceeded demand. Nevertheless, sellers have refrained from drastic price cutting, and prices have stabilized near the $17.00 level. The speculation and uncertainty stemming from the District Court order requiring DOE to limit the enrichment of foreign-origin uranium for use in US reactors may in time have a substantial market impact, but as of the end of June, it had little noticeable effect on uranium prices. This is due largely to uncertainty regarding how and when any limitation or embargo might come into effect. Most US utilities appear to be waiting to determine what impact the recent developments will have on the market.

Buyer activity in non-US markets generally has been slight in recent months and outlook is pessimistic in the aftermath of the Chernobyl nuclear accident in the Soviet Union. Most European utility requirements are covered through the end of the decade. The few discretionary buyers have withdrawn from the market since the Chernobyl accident, which has created serious political problems for several European utilities, particularly in Central Europe. Indirectly, the accident is likely to cause the deferral of demand for several units and the abandonment of at least one nuclear power project for which the fuel has already been purchased. In addition to the effects of Chernobyl, European utilities view the District Court order in the USA as a possible source of downward pressure on uranium prices for non-US origin material. Given these developments, there is little motivation among Europeans to purchase now, and the same appears to be true in the Far East where opportunities could exist.

Conversely, an increase of buyer interest in US-origin uranium seemed to develop in the US utility market following the District Court order in June. However, adequate quantities of US-origin material were available to fill all buyer inquiries for US-origin uranium at prices only slightly above the current market values. Furthermore, at least one US buyer having a non-DOE enrichment contract entered the market to purchase material of any origin. As of the end of the month, despite some speculation in the USA, firm demand for large quantities of US-origin uranium had not emerged.

* * *

The decision handed down by Tenth District Court Judge J. R. Carrigan in the lawsuit involving three US producers and DOE drew a great deal of attention in the USA. Judge Carrigan's order, if not stayed, will likely force some US utilities to take some near-term action. This could involve feed transfers (e.g., *nationality swaps*, etc.), additional purchases of US-origin uranium, or new consideration by US utilities of overseas enrichment services as a short-term solution for utilizing their inventories of non-US origin feed.

US producers have reacted predictably. Most have either stopped offering uranium, withdrawn previous offers, or raised their offering prices. Those in the latter category are undoubtedly hoping for the development of a significant premium for US-origin material and wish to avoid underpricing their material. However, US utilities currently appear uninterested in entering agreements at these higher price levels. Whether a substantial premium for US-origin uranium will develop in the coming weeks or months will depend on the outcome of a complex network of legal and political issues. These interrelated issues, most of which are awaiting final legal, procedural, or executive authorization, are covered in detail in the following pages. In summary, they consist of the following:

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1. A decision may be made to grant DOE's motion to stay pending appeal the District Court order. The order requires DOE to implement limitations on the enrichment of non-US uranium for use in US plants. (See page 3.)

2. DOE has filed a notice of its intent to appeal the District Court's decision regarding Count I of the lawsuit (pertaining to an enrichment embargo). (See page 3.)

3. Near-term legislative solutions could also resolve many of the current conflicts. If the bill sponsored by New Mexico Senator Pete Domenici is passed by Congress incorporating in some form its present elements, it could well moot the Denver Court decision, in that the new law would take precedence over the judicial ruling. (See page 5.)

4. The US Trade Representative's findings that uranium import restrictions are not appropriate under present trade laws, combined with President Reagan's strong free-trade policies, must be considered as significant influences against any type of solution involving protectionist measures. While the Domenici legislation might be subject to a Reagan veto, the judicial ruling mandating enrichment restrictions may bring the Administration to the aid of DOE via some other political means. (See page 6.)

5. DOE is conducting a rulemaking for its proposed enrichment criteria covering, among other issues, the issue of import restrictions to maintain the viability of the US uranium production industry. This process may effectively moot the ruling in the lawsuit and prevent a situation in which non-US feed cannot be enriched for US utility use.

6. Finally, there are still substantial inventories of US-origin uranium around the world, held by entities unaffected by the District Court decision. Large quantities of this material may become available for swaps. Moreover, because of the increasing attention on public utility commission prudency hearings and other ratemaking procedures, US utilities are aware that uranium purchased at prices above spot market can be subject to cost disallowances. Therefore, most US utilities can be expected to delay buying decisions until the implications of restrictions on the use or enrichment of foreign-origin uranium become clearer.

In the longer term, it appears that some type of limitation on the use of non-US uranium by US utilities probably will be enacted, as a result of either the court order, DOE rulemaking or legislation. If the limitation is severe, a premium for US-origin material is almost certain to develop, but it is premature to speculate on the size of such a premium. The extent to which a shorter-term premium for US-origin material will develop is also unclear.

There have been episodes of two-tiered pricing in the past. In the early 1970s a total US embargo caused non-US origin prices to be about ten percent below prices for US uranium. In addition, for a period in the late 1970s, nonproliferation legislation in the USA, Canada and Australia gave rise to a temporary premium of less than five percent for uranium unencumbered by special restrictions on reprocessing. Moreover, there are always variations in uranium prices depending on the specific requirements for location, form, origin, and delivery schedule.

It is important to note that a two-tiered price in favor of US-origin material is not necessarily a definite long-term result of either Carrigan's decision or another action designed to protect domestic producers. Because Carrigan's September 1985 decision on Count II of the lawsuit invalidated the USEC (a ruling still under appeal), and because the court order could lead to *force majeure* situations between DOE and some US utilities, some US utilities may ultimately purchase substantial non-DOE enrichment services to replace their DOE services.

* * *

ENRICHED URANIUM AND SWUS

The **SWU Value** as of June 30, 1986, is $78 per SWU, up $3 since last month. This refers to SWU at a tails assay of 0.30 weight-percent U_{235} and for delivery within one year. One secondary market transaction that was in negotiation at the end of May, for a relatively large quantity of SWU, was concluded soon thereafter and is reported this month.

The secondary market for SWU remains thin due to the general absence of buyers with near-term needs. The availability of significant quantities of DOE or Eurodif-origin SWU at prices below $80 has become less certain in recent weeks and is the reason for the slight rise in SWU Value. However, a single expression of firm interest can influence prices in this market. New interest in the *possibilities* for secondary market enrichment has been generated by the District Court ruling, in that US utilities may consider it as a means of enriching non-US uranium if DOE is prevented from doing so. While several utilities are considering overseas enrichment for their non-US uranium inventories as a short-term solution, there has been no evidence that any US utilities are preparing to abandon their DOE contracts in favor of long-term secondary market enrichment services.

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RULING ON US URANIUM PRODUCERS VS. DOE LAWSUIT

US District Court Judge J.R. Carrigan has ruled on the remaining counts in the lawsuit filed in December 1984 by three US uranium producers — Western Nuclear, Inc.; Energy Fuels Nuclear, Inc.; and Uranium Resources, Inc. Their action had the support of other US producers, who later joined in the formation of an industry trade group known as the Uranium Producers of America (UPA). (Judge Carrigan ruled in favor of the producers on Count II in September 1985, and that issue has since resided in the Tenth Circuit Court of Appeals.)

The full text of Carrigan's order, covering Counts I, III, IV and V, is reprinted below. Count I, which asserted that DOE violated the Atomic Energy Act of 1954 [42 U.S.C. Sec. 2201(v) as amended], was the most significant issue in the five-count civil action. Part of the Act states that DOE, "....to the extent necessary to assure a viable domestic uranium industry, shall not offer such (enrichment) services for source or special nuclear materials of foreign origin intended for use in a utilization facility within or under jurisdiction of the United States." In September 1985, the Secretary of Energy had declared the US industry non-viable. On the basis of that declaration and other arguments, Carrigan found that the producers were indeed entitled to relief under section 2201(v) of the Atomic Energy Act.

The producers had asked the Court to order DOE to commence a rulemaking leading to the adoption of limits on the enrichment of foreign-source uranium for domestic end use, and to impose interim limitations on such enrichment pending the outcome of those proceedings. Carrigan ruled that DOE had violated the Act, denied DOE's requests to stay the proceedings,

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IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLORADO

Civil Action No. 84-C-2315

WESTERN NUCLEAR, INC., et al.,

Plaintiffs,

v.

F. CLARK HUFFMAN, et al.,

Defendants.

ORDER

CARRIGAN, J.

Oral argument was heard on June 5, 1986, on all pending motions in this case. The motions are directed to counts I, III, IV and V of the plaintiffs' complaint. Having heard the arguments of counsel with respect to the pending motions, having read the extensive briefs, and being fully advised, I hereby enter the following orders:

1. Plaintiffs' Motion for Summary Judgment with respect to Count I is granted and the defendants' Cross-motion for Summary Judgment with respect to Count I is denied. Defendants' request for a stay with respect to Count I is denied.

In light of the record, including affidavits submitted by the plaintiffs and *amici*, and including the information contained as part of the Secretary of Energy's determination in September 1985 that the domestic uranium industry was not viable, and in light of the Department of Energy's continuing refusal to recognize its obligations under 42 U.S.C. § 2201(v), I find that there is an immediate necessity for injunctive relief and therefore order as follows:

Given the Department of Energy's need to plan its implementation of the mandate of § 161(v) of the Atomic Energy Act, 42 U.S.C. § 2201(v), and pending the completion of the rule-making ordered herein: (a) the Department shall restrict its enrichment of source or special nuclear materials of foreign origin intended for use in a utilization facility within or under the jurisdiction of the United States to twenty-five percent of such materials enriched over the time period June 6, 1986, to December 31, 1986; (b) as of January 1, 1987, and continuing until the viability of the domestic uranium industry is assured, the Department shall not offer or provide any enrichment services for source or special nuclear materials of foreign origin intended for use in a utilization facility within or under the jurisdiction of the United States.

The Department shall commence administrative rule-making proceedings to establish criteria for providing enrichment services that shall comply with the mandate of 42 U.S.C. § 2201(v) to assure the maintenance of a viable domestic uranium industry. These criteria shall include the extent to which enrichment services may be made available for source or special nuclear material of foreign origin intended for use in a utilization facility within or under the jurisdiction of the United States. If the Department believes that criteria less restrictive than those imposed by this order would assure the maintenance of a viable domestic uranium industry, then the Department shall clearly articulate its reasons for such a position.

The court retains jurisdiction of this matter to assure compliance with this order.

2. With respect to the issues raised by Count III of the complaint, and the motions pending concerning Count III of the complaint, the defendants' Motion for Stay is granted for ninety days.

3. With respect to Count IV of the complaint, the defendants' Motion to Dismiss is denied and the defendants' Motion for Stay is denied. The defendants' Motion for Summary Judgment with respect to Count IV is granted.

4. Upon motion of the plaintiffs, there being no objection from the defendants, the plaintiffs are granted leave to withdraw Count V of their complaint without prejudice.

Dated at Denver, Colorado, June 10, 1986.

BY THE COURT:
JIM R. CARRIGAN, JUDGE
UNITED STATES DISTRICT COURT

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and granted the producers' motion for summary judgment. Carrigan then asked that counsel prepare for his signature an order consistent with his ruling. The producers' proposed order contained the provision that 75 percent of the uranium enriched by DOE from June 6, 1986 to December 31, 1986 for use in US reactors must be of US origin; and that as of January 1, 1987, and continuing until the viability of the domestic uranium industry was assured, DOE shall not enrich any foreign uranium for use in US reactors. DOE filed an opposition to the producers' proposed order, listing as grounds the following:

1. "An injunction placing any restrictions on enrichment of foreign (uranium) by DOE will create hardships for DOE, the domestic utilities and their customers, and raises serious international policy issues..."

2. (The producers' proposed order) "is inconsistent with 42 U.S.C. Sec. 2201(v) and exceeds the request for injunctive relief requested by (the producers)...Any such injunction clearly usurps both the role of the executive branch to establish criteria and the role of the legislative branch to review such criteria."

DOE concluded by requesting that the proposed order be modified accordingly. However, the order signed by Carrigan closely resembled the producers' draft. It called for immediate *injunctive* relief, ordering the same provisions for limitations on enrichment of foreign uranium for use in US reactors as were contained in the producers' proposal. (Injunctive relief requires some action on the part of DOE, as opposed to *declaratory* relief, which only would have expressed the opinion of the Court without ordering anything to be done.) Carrigan added that if DOE believes that *less restrictive* criteria would be sufficient to maintain a viable domestic uranium industry, then DOE must "clearly articulate its reasons for such a position." Carrigan also retained jurisdiction over the matter to assure compliance with the order.

Several days later, DOE filed three documents in the District Court.

1. A *Notice of Appeal* advised that DOE was appealing to the Tenth Circuit Court of Appeals the order granting the producers summary judgment on Count I and entering an injunction on that Count.

2. A *Motion for Stay Pending Appeal* requested an order staying the injunction entered by Carrigan, pending resolution of the appeal on Count I. (As of press time, Carrigan had not responded to the motion.)

3. A *Memorandum in Support of Motion for Stay Pending Appeal* argued the rationale behind DOE's motion for stay pending appeal. The full text of the memorandum, including a declaration by Sherry Peske, DOE's Director of Marketing and Business Operations, is reprinted on page 10.

DOE, in the memorandum supporting the motion for stay pending appeal, argued that it already had in its possession a high percentage of foreign feedstocks designated for use in US reactors. DOE claimed the order would prevent it from enriching all of the delivered feedstock needed for US reactors. Therefore, domestic utilities and DOE would suffer "irreparable injury without a stay," which "could result in shutdowns of domestic reactors."

DOE also argued for the motion on the grounds of public interest, claiming that the injunction "impacts adversely on foreign trade, foreign policy, and the nuclear non-proliferation policy of the United States." Finally, DOE maintained that the injunction oversteps the limits of statutory interpretation, equating Carrigan's injunction with judicial rulemaking in that it effectively changes the enrichment criteria without Congressional review as required by the Atomic Energy Act.

The fate of the motion for stay pending appeal appears to be the crucial issue at present. Carrigan may grant or deny the motion. If he grants the motion, which seems unlikely considering the tone of his order, the injunction will not go into effect while the appeal in the Tenth Circuit Court is pending. The appeal process could take many months, as evidenced by the fact that Count II has been before the Circuit Court since September 1985. If Carrigan denies the motion for stay pending appeal, DOE is likely to request the Circuit Court to grant a stay. In short, the legal procedures are extensive and time consuming; a final resolution could be delayed until 1987.

While the issues in Count I have caused the greatest amount of speculation and concern, Judge Carrigan also ruled on the remaining counts in the lawsuit. *Count III* sought to require DOE to allow customers to vary their tails assays at no charge, because the surcharge for the variable tails assay option (VTAO) under the USEC tends to reduce uranium consumption. Carrigan granted DOE's motion for a stay of proceedings for 90 days, so there will be no ruling on this issue until at least September 1986.

Count IV sought to prohibit the use of the federal government stockpile, either through sales of pre-production inventories or through over-feeding the enrichment cascades (to save power costs). Apparently persuaded that DOE had not and would not be using its stockpile in such a manner, Carrigan denied DOE's motions for dismissal and stay, but granted summary judgment in favor of DOE on this issue.

At the Court's suggestion, producers' counsel moved to withdraw *Count V*, and leave was granted to withdraw it without prejudice. Among other issues, Count V had sought judicial validation and enforcement of the principle that the US uranium industry shall be maintained in a condition such that it shall be capable of supplying 100 percent of US requirements at any time.

Nuexco Monthly Report 206 (October 1985, page 4) contained an analysis of Carrigan's September 1985 ruling on *Count II* of the lawsuit. Count II sought a declaration that the Utility Services Enrichment Contract (USEC) is null and void. Judge Carrigan ruled that the USEC violated the Atomic Energy Act because the contract amounted to a change in the criteria governing enrichment, and he entered a summary judgment in favor of the producers with respect to Count II. The judgment was appealed by DOE, and is now before the Tenth Circuit Court of Appeals.

TERMS OF THE DOMENICI LEGISLATION

Another possible resolution to the complicated network of interrelated issues takes the form of legislation introduced by Senator Pete Domenici (R, New Mexico). The draft legislation, which would require that at least 50 percent of all uranium used in US reactors in a given year be of domestic origin, is currently undergoing revisions. Nevertheless, the aim of the omnibus bill is to provide solutions to a variety of the industry's problems in one legislative measure.

Entitled the "Uranium Revitalization and Tailings Reclamation Act of 1986," the stated purpose of the Act is to "ensure an adequate long-term supply of domestic uranium and enrichment for the nation's nuclear power program; to reestablish a viable domestic uranium industry and…a competitive domestic enrichment program, and to…establish a comprehensive system for financing reclamation and other remedial action…" at uranium mills. Among other things, the legislation would address the following issues:

1. *Uranium Usage* — The bill would require the US Trade Representative to seek voluntary agreements limiting uranium imports from the major uranium-producing nations. Failing such agreements, the bill would require that at least 50 percent of the fuel loaded into civilian nuclear power reactors during any calendar year be domestic uranium through the year 2000. The penalty for not complying with this requirement would be a $500 charge for every kilogram of non-US uranium loaded into a reactor in a given year over the 50-percent limitation. However, the bill contains a grandfather clause; foreign uranium delivered to US utilities under contracts entered into prior to April 8, 1986 could be used, even if it caused the amount of foreign uranium used to exceed 50 percent. Compliance by plant licensees would be self-policing through an annual certification of the quantities of domestic and foreign uranium used.

2. *Viability* — The Atomic Energy Act requirement that the Secretary of Energy takes action so as to maintain a viable domestic industry (by limiting enrichment of foreign uranium for US use) would be waived until December 31, 2000.

3. *Government Uranium Purchases* — Agencies of the US Government (such as the Tennessee Valley Authority) would be required to purchase only domestic-origin uranium.

4. *Mill Tailings Reclamation* — Some costs of "remedial action" performed by mill owners or licensees would be subsidized by the Uranium Mill Tailings Fund. Contributions to the Fund would total about $1 billion, and would be made by the following parties in approximately these amounts.

Uranium Mill Owners or Licensees	— 30 percent
Nuclear Power Reactor Licensees	— 30 percent
Federal Government	— 30 percent
States with Active Uranium Mills	— 10 percent

5. *DOE's Cost Recovery* — DOE will contribute $350 million to the Mill Tailings Fund from its uranium enrichment revenues. This amount "shall be deemed to fully and completely repay the Treasury for one hundred percent of any and all debt the Department of Energy Uranium Enrichment Program has incurred prior to FY1986."

6. *Enrichment Contracts* — DOE's Utility Services Enrichment Contract (USEC) would be approved as is, with the exception that DOE would be precluded from charging a fee for the selection of variable tails assay option (VTAO) within the 0.2 percent to 0.3 percent range authorized in the contract.

7. *Privatization* — The Secretary of Energy would be required to submit to Congress a plan for the reorganization and commercialization of DOE's enrichment program. The plan would establish a Uranium Enrichment Services Corporation which would eventually be owned by the private sector. The plan, when submitted to Congress would include enrichment criteria for the first five years of the Corporation's service, the technology available to the Corporation, a business plan and other considerations.

Some parts of the bill are undoubtedly encountering opposition from various interest groups, including utilities and the Reagan administration. By writing down DOE's enrichment enterprise debt to only $350 million as of FY86, the bill is certain to mobilize taxpayer lobbying groups which claim that the debt is as high as $7 billion. The 50-percent limit on foreign uranium use probably represents the most politically sensitive aspect of the bill. The Edison Electric Institute (EEI), a utility industry association, submitted written testimony to a Senate subcommittee in May. The testimony supported many aspects of the bill, but strongly objected to the bill's import restrictions. In 1982, a similar effort by Domenici to impose uranium import restrictions was defeated in Congress.

Due to the Reagan Administration's free trade stance, the bill is likely to encounter significant resistance in the Senate and a possible veto from the President. However, in light of the injunction issued by the Federal District Court pertaining to use of foreign uranium, DOE's interest might be better served under

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the conditions of the Domenici bill. The bill provides for several other incentives for DOE to lend its support, namely the blessing given to the USEC and the write-off of virtually all of DOE's enrichment debt (the latter provision has raised substantial opposition from taxpayer lobbies). Moreover, the considerable attention devoted toward rulemaking (in an attempt to validate the USEC) could be averted. Should DOE's position in the litigation ultimately fail, the Department may seek Congressional support for the passage of the Domenici bill. In that event, DOE and the US producers would be in very similar lobbying positions.

NON-VIABILITY OF THE US URANIUM INDUSTRY AND IMPLICATIONS FOR US TRADE POLICIES

In September 1985, Secretary of Energy John Herrington declared that the US uranium industry was not viable in 1984. That declaration eventually became a significant factor in the Tenth District Court's findings regarding Count I of the US producers vs. DOE lawsuit. Stating that "I have taken steps to help the miners and millers in this important industry that is currently under a great deal of strain," Herrington:

1. Authorized DOE to offer a free VTAO each year to all customers that commit to buy 100 percent of their requirements from DOE over a rolling five-year period. (This item was sought under Count III of the lawsuit, but Judge Carrigan granted DOE's motion for a stay of proceedings for 90 days on this count.)

2. Postponed for one year a DOE plan to feed some of its own uranium stockpile into enrichment plants. (This item was sought under Count IV of the lawsuit. Carrigan apparently accepted DOE assurances that it did not plan to use the stockpile, and granted summary judgment in favor of DOE.)

3. Asked the United States Trade Representative, Clayton K. Yeutter, to examine the facts and implications of uranium imports and corresponding foreign trade and policy issues with a view to determining the appropriate courses of action under US trade laws. Yeutter was asked to report back in three months.

Yeutter's December 26, 1985 letter advising Herrington of his findings is reprinted below. His conclusions are based on the determination that canceled and delayed nuclear plants prevented demand from reaching expected levels, resulting in large excess inventory. This inventory overhang, combined with the recent high-grade discoveries in Saskatchewan which indicate the likelihood of long-term cost advantages for those producers, will continue to depress market prices for some time.

Yeutter then outlined the various legal means for imposing import restrictions by examining several US trade laws. **Section 201 of the Trade Act of 1974** is designed to provide temporary relief to domestic industries "seriously injured, or threatened with serious injury, by increased imports." Relief can be granted, following an investigation by the International Trade Commission and review by the President, generally for a period of only five years. Yeutter deemed this option inappropriate for several reasons:

1. He doubted that the International Trade Commission could be persuaded that the industry's problems are due more to imports than to other reasons, chiefly the reduced demand.

2. The industry's problems appear to be long-term in nature, rather than temporary, because of the competitive advantage for lower-cost producers elsewhere. This particular statute is designed to provide temporary relief. Moreover, the limited duration of the relief would not be sufficient to make the US industry viable given the nature of the foreign competition's advantages.

Section 232 of the Trade Expansion Act of 1962 provides relief when imports threaten national security. This section was found to be inappropriate for two reasons.

1. Uranium for commercial power generation, not military uses, is at issue.

2. Canada, a stable ally, is the principal source of uranium imported in the USA.

With regard to **Section 161(v) of the Atomic Energy Act,** Yeutter argued that to restrict enrichment of foreign uranium would only serve to "shift enrichment activity away from US government facilities to foreign facilities, thereby eroding the position of US enrichment enterprises." This argument is used by DOE in its memorandum supporting a stay pending appeal of the District Court injunction.

Thus, the Trade Representative's study found that it would be inappropriate to invoke any of the relevant trade statutes when:

— the actual benefit to the US production sector was undemonstrable and probably negligible; and

— the adverse impact on US trade relations, especially with Canada, the largest US trading partner, was unwarranted and could lead to retaliatory actions by other trading partners. The Reagan Administration is concerned about its role in upcoming multilateral trade negotiations, and bilateral trade liberalization discussions with Canada already have begun. With conf[illegible] over tariffs on items such as timber, and the desire to avoid any type of trade war with Canada, it is doubtful that the Administration will risk jeopardizing a long-term, comprehensive trade agreement for the sake of uncertain benefits to US uranium producers.

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December 26, 1985
Honorable John Herrington
Secretary of Energy
Washington, D.C. 20585

Dear John:

As a follow-up to your request of September 26 for an examination of the situation of the domestic uranium mining and milling industry, we have completed our review of the issue and are now able to provide you with preliminary recommendations.

This is one of the more difficult questions we have studied in recent months. It involves, as many trade issues do, trying to achieve a delicate balance of domestic industry concerns, consumer interests, general economic policy, foreign, and, of course, trade policy concerns. Sometimes a policy option will emerge in the course of analysis which arrives at a desired balance that leaves most parties at least relatively satisfied with the outcome. Unfortunately, in this case, that seems impossible.

In reviewing the economic situation of the US uranium industry, we drew on existing expertise within various US Government agencies, including your own Department. Also included in our interagency working group were the Departments of State and Commerce and the Office of Management and Budget. We consulted with interested parties outside the Government on an informal basis, and our preliminary conclusions were reviewed by the Trade Policy Staff Committee, which included all agencies concerned with international trade. While our review focused on the trade policy aspects of the situation, it included all relevant factors and thus our comments are framed within the broad context of the uranium issue.

Without a doubt, the domestic uranium mining and milling industry has severe economic problems, as you well know from your own review and viability determination. From their peak in the 1970's production and employment have fallen to very low levels. However, it would appear from our review that the principal cause of this decline is the failure of demand to materialize in the early 1980's as a number of nuclear power plants were delayed or cancelled. As a result, a huge excess inventory was created that could take up to ten years to work off, with a consequent depressing effect on market prices. On top of this, recent uranium discoveries in Canada indicate a long-term comparative advantage for their producers in terms of ore quality and production cost.

Against this background of the outlook for the next five to ten years, we evaluated the appropriateness and likely effectiveness of existing trade laws to help the US industry and the trade policy implications of initiating action under these laws. The following is a summary of our preliminary assessment.

Section 201 of the Trade Act of 1974 is intended to provide temporary relief to domestic industries seriously injured, or threatened with serious injury, by increased imports. The relief provided (following an extensive investigation by the International Trade Commission and a review and decision by the President) is generally only for up to five years to allow the affected domestic industry time to adjust. There are two principal questions relative to this discussion: (1) Is self-initiation of Section 201 appropriate to the current situation? and (2) Should the special provisions of Section 170B of the Atomic Energy Act regarding self-initiation of a Section 201 investigation be invoked?

Regarding the first question, we would advise against self-initiation of a Section 201 investigation at this time for several reasons. First, it is unlikely that the International Trade Commission would find that the industry's problems are due more to imports than to any other single cause; significantly reduced demand appears to be the major factor. Second, since the industry's problems appear to be long-term rather than temporary because of the fundamental comparative advantage of Canadian and Australian producers, we do not believe Section 201 is appropriate. Third, even if Section 201 relief were provided, it appears that its effects, while marginally improving the industry's position, would not be sufficient to make the domestic industry viable, especially in view of its limited duration and the substantial foreign advantage with respect to ore quality and production cost.

Regarding the second question, we would advise against your making a prior determination of the effect of imports on the domestic industry, even if self-initiation of a Section 201 investigation were appropriate, because of the complex legal issues which could result from a pre-investigation injury finding by an agency other than the ITC.

Section 232 of the Trade Expansion Act of 1962 provides relief where imports are found to be threatening our national security. Uranium for military uses is not an issue here, but only uranium for commercial electric generation. The principal source of imports is Canada, and immediate neighbor and a longtime stable ally. For this and other reasons, we do not believe it would be appropriate to self-initiate an investigation at this time.

We also examined the possibility of self-initiation of countervailing duty or antidumping investigations, based on various allegations of subsidies and dumping with regard to Canadian imports. From a preliminary and informal analysis of the available information, we do not believe such actions would be effective or apppropriate. Our industry, of course, is free to file petitions of its own if it believes such actions are a cause of material injury. However, we feel the allegations are not such as to merit the exceptional step of self-initiation since, even accepting the allegations at face value, the resulting duties would not be sufficient to offset the cost advantage of Canadian producers.

With regard to the authority to restrict enrichment of foreign uranium under Section 161(v) of the Atomic Energy Act, it appears that a major consequence would be the shift of enrichment activity from US government facilities to foreign facilities, thereby eroding the position of US enrichment enterprises.

In summary, action under the US trade statutes does not appear to be appropriate in regard to both the short- and long-term problems facing the domestic uranium mining and milling industry. Moreover, any remedy granted under existing law which might provide the extent of relief requested by the industry would only be short-term, while at the same time having an adverse impact on our trade and other relations with important trading partners without resolving the long-term problems of the industry. For example, we have just begun discussions with Canada on bilateral trade liberalization. Short-term actions adversely affecting Canadian trade would therefore be ill-advised, particularly if they did not lead to a permanent restoration of competitiveness for our industry. In addition, for any trade restriction not in response to a verified unfair trade practice, we would also owe compensation to, or face retaliation by, our other trading partners whose imports would be reduced. Thus, other sectors in the US economy would be asked to make sacrifices for any short-term import relief provided for the uranium industry.

For these reasons, I would advise against taking any action at this time to restrict uranium imports under existing law. I hope these comments are responsive to your request. If you have any further questions, please give me a call.

Sincerely,
Clayton Yeutter

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US UTILITIES AND THE DISTRICT COURT INJUNCTION

Uranium and Enrichment Commitments

The uncertainty created by the legislative and judicial developments currently affecting the industry — the District Court ruling, uranium and enrichment-related legislation before Congress, DOE rulemaking and proposed revisions to the enrichment criteria, US trade negotiations with Canada — has prompted a great deal of speculation on probable outcomes and implications for US utilities. To the degree that limitations on the enrichment of non-US uranium for use in US reactors might become effective, it is interesting to try to examine the situation of US utilities in terms of origin of uranium supply and enrichment service contracting. Unfortunately, such generalizing often yields results that are inconclusive. For example, Nuexco estimates that US utilities have contracted to import some 7.2 million pounds U_3O_8 equivalent in 1986. They also have current contracts to import some 4.3 million pounds in 1987 and 5.7 million pounds in 1988. However, it is impossible to determine what effect these quantities, taken by themselves, will have on inventory balances in the USA. For instance, Nuexco expects US producers and suppliers to import about 3.9 million pounds U_3O_8 in 1986. Most of this will probably be redelivered to US utilities, but it will remain foreign origin. Deliveries of US uranium held by non-US producers or traders must also be considered.

Even more difficult to predict are utilities' rates of consumption, both in the strictest sense of the term and in terms of overall fuel procurement and fuel management strategies. Units currently undergoing licensing procedures are subject to the delays that have now become commonplace, and which serve to delay the onset of inventory drawdown. Some utilities may choose to alter their 180-day notices of scheduled enrichment withdrawals from DOE, so as to use foreign-origin inventory for their DOE enrichment contracts to the maximum extent possible, saving their US-origin feed for future use. Other utilities might preserve their US inventories for later use by substituting foreign uranium bought on the spot market.

The scenarios presented above all assume that USEC holders continue to buy DOE's enrichment services. At present, only five US utilities (including one utility group) are not covered by the USEC. Ultimately, if DOE is forced to comply with a judicial order restricting its enrichment services, other utilities can be expected to seek enrichment services elsewhere, at least for the short-term. The scenarios for this move are as varied as the agreements that DOE entered into with the utilities when it introduced the USEC. Some utilities might claim breach of contract if DOE cannot agree to accept the feed origin specified by the utility in its required 180-day notice; some might exercise termination clauses; others, using as justification the ruling that the USEC was null and void, might simply abandon the contract and seek replacement contracts overseas. At present, there have been no indications that any USEC holders have taken such action. These reactions will become more evident when DOE's legal and political alternatives have been exhausted.

Table 1 shows the US utilities that signed the USEC and therefore are currently under contract to DOE for at least 70 percent of their enrichment requirements. It also lists the utilities that did not sign the contract and either have entered agreements with a non-US enricher or have no long-term contracts.

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Table 1

ENRICHMENT STATUS OF US UTILITIES

Signed the Utility Services Contract

Arizona Public Service Company
Baltimore Gas & Electric Company
Carolina Power & Light Company
Cleveland Electric Illuminating Company
Commonwealth Edison Company
Consolidated Edison Company
Consumers Power Company
Dairyland Power Cooperative
Detroit Edison Company
Duke Power Company
Duquesne Light Company
Florida Power Corporation
Florida Power and Light Company
General Public Utilities Company
Gulf States Utilities
Houston Lighting & Power Company
Illinois Power Company
Iowa Electric Light & Power Company
Kansas Gas & Electric Company
Long Island Lighting Company
Middle South Services
Nebraska Public Power District
New York Power Authority
Niagara Mohawk Corporation
Northeast Utilities
Northern States Power Company
Ohio Edison Company
Omaha Public Power District
Pennsylvania Power & Light Company
Philadelphia Electric Company
Portland General Electric Company
Public Service Company of Colorado
Public Service Electric & Gas Company
Public Service Company of New Hampshire
South Carolina Electric & Gas Company
Southern California Edison Company
Southern Company Services, Inc.
Tennessee Valley Authority
Texas Utilities Generating Company
Toledo Edison Company
Union Electric Company
Virginia Electric Power Company
Washington Public Power Supply System
Wisconsin Electric Power Company
Wisconsin Public Service Company

Did Not Sign the Utility Services Contract

American Electric Power Company
Boston Edison Company
Maine Yankee Atomic Power Company
Pacific Gas and Electric Company
Sacramento Municipal Utility District
Vermont Yankee Nuclear Power Corporation
Yankee Atomic Electric Company

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IN THE UNITED STATES DISTRICT COURT FOR THE DISTRICT OF COLORADO

WESTERN NUCLEAR, INC., et al.,

Plaintiffs,

v.

F. CLARK HUFFMAN, et al.,

Defendants.

Civil Action No.
84-C-2315

DEFENDANTS' MEMORANDUM IN SUPPORT OF MOTION FOR STAY PENDING APPEAL

On June 20, 1986, the Court issued its order on Counts I, III, IV and V of this case. In conjunction with the declaratory judgment entered on Count I, this Court issued an injunction prohibiting the Department of Energy ("DOE") from enriching source of special nuclear materials of foreign origin intended for use in a utilization facility within or under the jurisdiction of the United States in excess of twenty-five percent (25%) of such materials enriched over the time period of June 6, 1986 to December 31, 1986. Thereafter, the Court's injunction restricts the enrichment of all source or special nuclear materials of foreign origin intended for use in a utilization facility within or under the jurisdiction of the United States until the viability of domestic uranium is assured or DOE completes its rulemaking under 42 U.S.C. § 2201(v).

As defendants have previously demonstrated to this Court, the harmful effects of this injunction on DOE, the domestic utilities and the public sector are immediate and irreparable. Plaintiffs, however, are unlikely to realize any significant benefit from this sweeping injunction, and any injury they suffer if a stay is issued is insubstantial when balanced against the harm to DOE and others. Moreover, on the merits of Count I, including the appropriateness of injunctive relief, defendants submit that the very nature of the legal issues favor a stay pending appeal. For these reasons, more fully articulated below, defendants request that the Court stay the effects of the injunction pending resolution of the appeal filed by defendants on Count I.

ARGUMENT

A STAY SHOULD BE GRANTED TO PRESERVE THE STATUS QUO PENDING APPEAL

In determining whether to grant a stay pending appeal, this Court must weigh: (1) whether the applicant has made a strong showing that he is likely to prevail on the merits; (2) whether without the requested relief the applicant will be irreparably injured; (3) whether the issuance of the stay would substantially harm the other parties; and (4) whether the issuance of the stay would promote the public interest. *Battle* v. *Anderson*, 564 F.2d. 388, 397 (10th Cir. 1977); *National Indian Youth Council* v. *Andrus*, 623 F.2d 694, 695 (10th Cir. 1980); *Virginia Petroleum Jobbers Association* v. *FPC*, 259 F.2d 921, 925 (D.C. Cir. 1958). Applying these standards to this case, it is clear that defendants can establish their entitlement to a stay pending appeal of the injunctive relief granted on Count I.

I. Defendants And The Domestic Utilities Will Suffer Irreparable Injury Without A Stay And No Comparable Injury To Plaintiffs Will Result If A Stay Is Granted

Unless a stay is entered pending appeal DOE will be forced to inform its domestic utility customers that it cannot enrich much of the feedstock already delivered to DOE for enrichment in 1986. Declaration of Sherry E. Peske, Director, Office of Marketing and Business Operations, Uranium Enrichment Program, United States Department of Energy (hereinafter "Peske Declaration") ¶ 17. As Ms. Peske explains in her declaration, over 50 percent of the feedstock already delivered to DOE for enrichment in 1986 is of foreign origin. *Id.* ¶ 15. Because of the high percentage of foreign origin material already in DOE's possession, which is designated for use in domestic facilities, DOE projects that a minimum of 35% foreign origin uranium would be enriched through December 31, 1986, even if no further deliveries of foreign feedstock are accepted by DOE for 1986. *Id.* ¶ 17. Thus, the 25% restriction in the June 20 Order raises serious practical problems, which if not stayed pending appeal, could result in shutdowns of domestic reactors. *See* June 13, 1986 Declaration of Loring Mills filed with Joinder of Amici Curiae In Opposition to Injunction, ¶ 9.

Moreover, DOE's inability to enrich foreign uranium for its customers is likely to result in claims from domestic utilities that DOE has breached its enrichment contracts with them. If these claims are successful, DOE could be found liable for millions of dollars in losses suffered by the domestic utilities as they exercise their options to buy more costly domestic uranium or enrich overseas. Peske Declaration ¶ 7.

In addition to facing possible costly and protracted contract litigation over its inability to enrich foreign origin uranium for its domestic customers, DOE is faced with the prospect of substantial losses of enrichment sales to both domestic utilities and foreign customers. Any significant loss of business by DOE will necessitate price increases for enrichment services with the likely result of even more DOE customers terminating their enrichment contracts in favor of less costly foreign enrichment. Peske Declaration ¶¶ 9-12. This loss of business could result in monetary losses to DOE of as much as $420 million for calendar year 1987 and $60 million for the period August through December 1986. *Id.* ¶ 11. Since a reversal of the Court's Order on appeal will not restore the loss of business and lost revenues to DOE, its harm is clearly irreparable.

Plaintiffs on the other hand, have made no effort to document their claim that the injunction will assist their industry in any meaningful way. As long as enriched uranium can be brought into the United States more economically the domestic utilities will have no incentive to purchase the more expensive domestic uranium for enrichment by DOE. It is primarily for this reason that the injunction will not aid the viability of the domestic mining industry. *Id.* ¶ 13.

II. The Public Interest Would Be Best Served By The Issuance Of A Stay

In determining whether to issue a stay pending appeal it is appropriate to consider the relative harm to the public interest. As the District of Columbia Circuit stated: "[t]he interests in private litigants must give way to the realization of public purpose." *Virginia Petroleum Jobbers Ass'n* v. *FPC*, 259 F.2d at 925.

In this instance, the declarations of James B. Devine, on behalf of the State Department and Robert A. Reinstein, on behalf of the United

States Trade Representative's Office, filed with the Court on June 16, 1986 and incorporated herein by reference, provide clear evidence that the public interest is best served by issuance of a stay pending appeal. As these declarations reveal, the nature of this Court's injunction both in its timing and content, impacts adversely on foreign trade, foreign policy, and the nuclear non-proliferation policy of the United States.

In addition, the consumers of electric power will likely suffer rate increases during the pendency of this appeal generated by the increased costs to the utilities associated with the injunctive relief entered on Count I. *See* June 13, 1986 Declaration of Loring Mills ¶ 12.

For these reasons, the public interest strongly favors issuance of the requested stay pending appeal.

III. There Is A Substantial Likelihood That Defendants Will Prevail On The Merits Of Its Appeal

The Court's holding that DOE has no discretion to implement § 161v of the Atomic Energy Act, 42 U.S.C. § 2201(v) raises significant and serious legal issues for appeal. For the purposes of this motion defendants recognize that they are unlikely to convince the Court that its recent decision granting summary judgment to plaintiffs on Count I was in error.

The Court's decision to issue an injunction, however, goes well beyond the statutory interpretation question presented to the Court in Count I. This injunction is akin to judicial rulemaking in that it substitutes its own enrichment criteria for those now in effect, without the benefit of Congressional review as contemplated by § 161(v). Because the injunction is not a *status quo* injunction but changes the enrichment rules effective immediately, the Court's consideration of the merits factor should weigh in favor of a stay.

Moreover, as the Court of Appeals of the District of Columbia Circuit recognized in *Washington Metropolitan Area Transit Comm'n* v. *Holiday Tours, Inc.* 559 F.2d. 841, 843 (D.C. Cir. 1977), a "court is not required to find that ultimate success by the movant is a mathematical probability, and indeed, . . . may grant a stay even though its own approach may be contrary to movant's view of the merits." Wooden application of the "likelihood of success" criteria would quickly swallow the whole of the equitable mechanism in Rule 62, Fed. R. Civ. P. since the court has already made a judgment on the merits. The decision in *Holiday Tours* made clear that:

> [W]hat is fairly contemplated is that tribunals may properly stay their own orders when they have ruled on an admittedly difficult legal question and when the equities of the case suggest that the *status quo* should be maintained.

559 F.2d at 844-45. Under this standard, the Court should stay its judgment.

CONCLUSION

For all of the foregoing reasons, defendants' motion for a stay pending appeal of the Court's June 20, 1986 Order and judgment granting injunctive relief on Count I should be granted.

Dated this 23rd day of June, 1986.

Respectfully submitted,

RICHARD K. WILLARD
Assistant Attorney General

ROBERT N. MILLER
United States Attorney

DENNIS G. LINDER

MARYANN CLIFFORD

Attorneys, Department of Justice
Civil Division, Room 3728
10th & Pennsylvania Ave., N.W.
Washington, D.C. 20530
Telephone: (202) 633-4775

Attorneys for Defendants

DECLARATION OF SHERRY E. PESKE

Sherry E. Peske, United States Department of Energy, Washington, D.C., declares and states as follows:

1. I am the Director, Office of Marketing and Business Operations, Uranium Enrichment Program, United States Department of Energy ("DOE"), Washington, D.C. I have held this position — first as Acting Director and then as Director — since December 1980. In this capacity, I am responsible for the contracting, marketing, production planning, and financial management functions of the Department's uranium enrichment program.

2. I am making this declaration for the purpose of explaining the practical effects that the Order signed by the District Court on June 20, 1986 will have on DOE, its customers and the domestic mining and milling industry. The statements made in this declaration are based on my personal knowledge, as well as on information provided to me by members of my staff in the course of our official duties.

I. BACKGROUND

3. The current Enrichment Services Criteria promulgated by DOE pursuant to §161(v) of the Atomic Energy Act ("AEA"), 42 U.S.C. §2201(v), contain no restrictions on the enrichment of foreign-origin uranium intended for use in domestic nuclear power reactors. Prior to 1977, there were criteria that provided that foreign-origin uranium could not be enriched if it was intended for use in domestic nuclear power reactors. However, an amendment to the Enrichment Services Criteria was promulgated on October 25, 1974 (See 39 FR 38016), which provided for the gradual removal of such restrictions beginning in 1977, and which eliminated any such restrictions in 1984. Based on [illegible] modification to the Criteria, DOE contracts with utilities contain no restrictions on enrichment of foreign-origin uranium, and domestic utilities have negotiated uranium supply contracts with foreign producers.

4. The Department of Energy is currently engaged in a rulemaking to revise its Enrichment Services Criteria. Although final Criteria have not been issued, the Department has stated in its proposed rule that, in its view, no level of restrictions on the enrichment of foreign-origin uranium would ensure or promote the viability of the domestic uranium producing industry. The severe difficulties currently facing the domestic mining and milling industry stem from various factors, including the disparity between the production costs of domestic and foreign uranium, shrinkage in the demand for nuclear power, excess uranium inventories, excess uranium production capacity, and cancellation of nuclear powerplants due to cost overruns and licensing delays. The basis for the Department's initial determination that restrictions on the

enrichment of foreign-origin uranium are not appropriate is set forth in DOE's Notice of Proposed Rulemaking published on January 29, 1986, at 51 Fed. Reg. 3624.

II. THE IMPACT OF THE INJUNCTION RESTRICTING ENRICHMENT OF FOREIGN SOURCE OR SPECIAL NUCLEAR MATERIAL

5. The restrictions that the district court's injunction imposes on DOE will create severe problems both for DOE and its domestic utility customers. These problems are both economic and practical.

6. I have reviewed the two affidavits of Loring Mills filed with the district court on behalf of the *amicus* domestic utilities. Each of the likely responses that the utilities would take in response to the injunction, as described by Mr. Mills in his June 13, 1986 affidavit, would result in significant, immediate, and irreparable harm to DOE.

7. As previously noted, the contracts in effect between DOE and its utility customers permit the utilities, in accordance with the current Enrichment Services Criteria, to determine for themselves whether to supply foreign or domestic source or special nuclear materials when they deliver uranium to DOE for enrichment. Any refusal by DOE to accept feed material of non-U.S. origin for enrichment, therefore, is likely to result in domestic utilities, who represent 65% of DOE's sales base, claiming that DOE is in breach of its contracts with such utilities. If such claims are successful, DOE would potentially be liable for the millions of dollars in extra costs that would be incurred by utilities that are forced to replace foreign-origin uranium with more costly domestic feed. In fact, several of DOE's customers already have informed DOE, informally, that they believe DOE may be liable for any damages they may suffer as a result of DOE's failure to perform its contractual commitments in accordance with the terms of their enrichment contracts. The utility customers' possible claims against DOE also may include lost value of foreign uranium already delivered to the utilities, damages that the utilities incurred as a result of claims made by the foreign producers for breach of contract, and any losses arising out of disruption of service caused by an inability to procure domestic feed in a timely manner.

8. Furthermore, if the imposition of feed restrictions by DOE is held to be a breach of contract, domestic customers probably would be able to terminate their enrichment contracts with DOE without cost. Indeed, even if such restrictions do not constitute a breach of contract, it still may be economically advantageous for customers to terminate their enrichment contracts with DOE, pay any termination charges, and purchase enrichment services abroad. There is no legal impediment to domestic utilities relying wholly on foreign procurement to meet their enriched uranium needs, and, as I explain below, the district court's injunction will be a powerful incentive for them to do so.

9. DOE is currently the highest price enrichment supplier in the world, and its European competitors have been actively (and in some cases successfully) trying to penetrate the U.S. market for several years. DOE anticipates that its foreign competitors will continue to be willing to offer attractive terms to utilities in order to induce them to satisfy their enrichment requirements abroad rather than from DOE. In fact, it has been the practice of DOE's competitors to agree to pay the termination charges that are incurred when DOE's customers terminate their enrichment contracts with DOE if the customers sign replacement contracts with the competitor. The financial incentive to procure enrichment services abroad rather than from DOE is likely to become significant if the price that a customer must pay for continuing to rely on DOE's services is procurement of domestic feed material, which is more costly than foreign feed material.

10. Moreover, contrary to plaintiffs' assertions, sufficient foreign enrichment capacity and foreign enrichment inventories do currently exist to supply domestic enrichment needs. Both Eurodif, a French-based enrichment supplier, and the U.S.S.R. presently possess substantial excess enrichment capacity. This, coupled with a very large existing inventory of foreign-origin enriched uranium, means that about 25 million SWU (five times the current annual domestic demand for enrichment services) are available in both FY 1986 and FY 1987 that could be substituted for procurement of enrichment services from DOE.

11. According to our current information, eight of DOE's domestic utility customers have already purchased foreign-origin uranium in the expectation that it will be enriched by DOE between now and December 31, 1986. Enrichment of this already purchased material would cause DOE to exceed the quota established by the district court's injunction. For 1987, sixteen of DOE's domestic utility customers have already committed to buy substantial quantities of foreign-origin uranium. If these utilities that have already bought or committed themselves to buy foreign-origin uranium decide that the injunction against enriching such material makes it unprofitable for them to procure enrichment services from DOE, DOE will lose approximately $60 million in enrichment sales through December 1986, and over $430 million in sales for calendar year 1987. These sales reflect the shift of about 5 million SWU to foreign enrichers over the next year-and-a-half. Furthermore, regardless of the final outcome of this lawsuit, the lost revenues of such sales could not be recovered by DOE.

12. The significant loss of enrichment sales by DOE that the injunction is likely to cause would make DOE non-competitive in the world enrichment services market. Because DOE is required by the AEA to recover its costs, and because a large portion of the costs attributable to DOE's enrichment enterprise are fixed, a decreased volume of sales will necessarily result in a higher unit cost. As previously noted, DOE is currently the highest priced enrichment supplier in the world and has already lost a substantial market share as a result of this factor. The higher unit costs that will result from a loss of enrichment sales will force DOE to raise its price and create an even greater disparity.

13. Finally, the ultimate effect of a restriction on DOE enrichment of foreign-origin uranium will be harmful to the entire domestic nuclear industry, including domestic producers of natural uranium. Most domestic DOE enrichment customers currently obtain a large percentage of their uranium requirements from domestic sources. In contrast, the customers of DOE's foreign competitors almost invariably use foreign ore. If DOE customers terminate their contracts and take their business to overseas enrichers, they may obtain all of their natural uranium needs from foreign produces, who offer attractively priced package deals. Thus, a loss of enrichment sales by DOE will actually risk futher damaging the U.S. mining and, indeed, could make its current nonviable condition irreversible.

III. THE IMPRACTICABILITY OF COMPLYING WITH THE SHORT TERM RESTRICTIONS ON ENRICHMENT OF FOREIGN-ORIGIN MATERIAL THAT ARE IMPOSED BY THE INJUNCTION

14. A minimum of six months normally elapses between the time that a utility receives uranium from a producer's mill and the date when

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the utility receives finished enriched uranium. This is due primarily to the physical and chemical processing times associated with uranium processing and enrichment. The utility customer must first have the natural uranium that it buys converted into a form ready for enrichment (uranium hexafluoride) — a process which requires approximately 90 days. Under its contract with DOE, a utility then must deliver the uranium hexafluoride (feedstock) to DOE between 90 and 180 days prior to the time requested by the customer for delivery of enriched product. This leadtime is essential, as the enrichment processing requires an elapsed period of at least 90 days.

15. In the normal course of its operational schedule, DOE already has enriched the feedstock for those domestic utility orders that will be delivered by DOE through early October 1986. Additionally, domestic utility customers have already delivered to DOE nearly 70 percent of the feedstock for their enriched product deliveries that are scheduled to occur between September and December 1986. Of this already delivered feedstock, over 50 percent is of foreign origin, according to the information supplied by utilities to DOE at the time they made their deliveries.

16. Furthermore, domestic uranium producers, such as the plaintiffs in this case, have been fulfilling some of their contractual obligations to domestic utilities by supplying foreign-origin uranium. Consequently, even when a utility has bought uranium from a domestic uranium producer, the uranium that the utility actually receives and delivers to DOE often consists of foreign-origin material. Indeed, according to statistics compiled by the Energy Information Administration of the DOE, such domestic producers have entered into contracts for over 37% of the total foreign-origin uranium currently under contract for 1985-1990 delivery. This situation has arisen because it is generally less expensive for domestic producers to purchase uranium from abroad for resale instead of producing the material domestically.

17. Even assuming that no further foreign-origin material is delivered to DOE by its utility customers for the remainder of calendar year 1986, DOE cannot stay within the quota established by the district court and still meet its contractually required enriched uranium delivery schedules. This situation exists because DOE's utility customers have already delivered most of their feedstock that is scheduled for enrichment in 1986, and the percentage of foreign-origin material already delivered exceeds the quota set by the district court. Even if no more foreign-origin material is delivered to DOE, DOE estimates that it will be required to enrich a minimum of 35% foreign-origin uranium between now and December 31, 1986.

18. This estimate, if anything, probably understates the problem because, as I have explained, the above estimate is predicated upon the assumption that the domestic utilities do not deliver any foreign-origin uranium between now and December 31, 1986. However, this assumption does not take into consideration the fact that, because of the leadtime required for converting natural uranium into uranium hexafluoride, the utilities have already submitted to the conversion plants most of the as yet undelivered uranium that is expected to be enriched by DOE later this year. Upon information and belief, the convertors already are processing such uranium. DOE estimates that if domestic utilities furnish DOE with the feedstock converted from uranium currently in the possession of the convertors, approximately 50% foreign-origin uranium would be required to be enriched between now and December 31, 1986.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on this 23rd day of June 1986.

SHERRY E. PESKE

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CURRENT MARKET DATA

June 30, 1986	Market Values	Active Supply[1] (thousands)	Active Demand[1] (thousands)
EXCHANGE VALUE	**\$17.00**/lb. U_3O_8	4,050	2,050
UF₆ VALUE	**\$48.25**/kgU		
CONVERSION VALUE	**\$1.80**/lb. U as UF_6	1,700	565
SWU VALUE 0.3 tails assay; delivery within one year	**\$78**/SWU		
LOAN RATE	**4%**/annum	0	0

	\$/lb. U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
TRANSACTION VALUE	17.20	2.2	14	3

[1] Supply and demand tables in *Current Market Data* section of this Report detail the numbers for each category.

DEFINITIONS

1. The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.
2. The **UF_6 Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.
3. The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.
4. The **SWU Value** represents Nuexco's judgment of the price at which transactions for the sale of significant quantities of SWUs of stated origin for delivery in the specified time period could be concluded as of the date indicated.
5. The **Loan Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.
6. The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
    a. Transactions closed within the previous three-month period for which delivery is scheduled within one year of the transaction date;
    b. At least ten transactions;
    c. Transactions involving a sum total of at least 2 million pounds U_3O_8 equivalent.

    The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

DERIVATIONS AND COMMENTS

1. All Market Values are based on:
    a. Data from recently completed transactions.
    b. Data from pending transactions.
    c. Firm bids to buy or borrow, and firm offers to sell or lend.
    d. Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell or lend.
2. Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these Market Values.
3. In the determination of the Conversion Value, Nuexco does not consider transportation charges other than those customarily provided by primary suppliers of conversion services.
4. The prices of conversion services or SWUs delivered under long-term contracts with primary suppliers are not considered in the determination of either the Conversion Value or SWU Value.
5. For the SWU Value, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight-percent U_{235} and a product assay of 3.0 weight-percent U_{235}, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
6. In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

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EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
Country (currency)	This Month (Jun 30, 1986)	Last Month (May 31, 1986)	12 Months Ago (Jun 30, 1985)	This Month (Jun 30, 1986)	Last Month (May 31, 1986)	12 Months Ago (Jun 30, 1985)
Australia (dollar)	25.35	23.64	22.50	65.92	61.47	58.49
Belgium (comm. franc)	765.08	796.25	921.94	1,989	2,070	2,396
Canada (dollar)	23.60	23.41	20.45	61.36	60.86	53.16
Finland (markka)	87.13	89.62	95.12	226.53	232.98	247.28
France (franc)	119.30	124.82	139.41	310.15	324.49	362.42
FRG (mark)	37.43	39.21	45.76	97.31	101.93	118.96
Italy (lira)	25,703	26,759	29,222	66,822	69,567	75,972
Japan (yen)	2,810	2,923	3,732	7,305	7,599	9,703
Netherlands (guilder)	42.12	43.93	51.69	109.50	114.20	134.38
South Africa (rand)	42.29	39.44	29.50	109.94	102.54	76.69
Spain (peseta)	2,399	2,484	2,619	6,238	6,457	6,810
Sweden (krona)	121.26	123.91	132.04	315.24	322.13	343.28
Switzerland (franc)	30.63	32.46	38.34	79.62	84.39	99.68
UK (pound)	11.10	11.42	11.58	28.86	29.68	30.11
US (dollar)	17.00	17.00	15.00	44.20	44.20	39.00

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
Country (currency)	This Month (Jun 30, 1986)	Last Month (May 31, 1986)	12 Months Ago (Jun 30, 1985)	This Month (Jun 30, 1986)	Last Month (May 31, 1986)	12 Months Ago (Jun 30, 1985)
Australia (dollar)	25.65	23.85	21.90	66.69	62.01	56.93
Belgium (comm. franc)	774.08	803.28	897.36	2,012	2,088	2,332
Canada (dollar)	23.88	23.62	19.90	62.08	61.40	51.74
Finland (markka)	88.16	90.41	92.58	229.20	235.04	240.69
France (franc)	120.70	125.92	135.69	313.80	327.36	352.76
FRG (mark)	37.87	39.55	44.54	98.45	102.83	115.79
Italy (lira)	26,005	26,995	28,443	67,608	70,181	73,946
Japan (yen)	2,843	2,949	3,632	7,391	7,666	9,444
Netherlands (guilder)	42.62	44.32	50.31	110.79	115.21	130.80
South Africa (rand)	42.79	39.79	28.71	111.23	103.45	74.64
Spain (peseta)	2,428	2,505	2,549	6,311	6,514	6,628
Sweden (krona)	122.68	125.00	128.52	318.95	324.97	334.13
Switzerland (franc)	30.99	32.75	37.32	80.56	85.14	97.03
UK (pound)	11.23	11.52	11.27	29.20	29.94	29.31
US (dollar)	17.20	17.15	14.60	44.72	44.59	37.96

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on June 30, 1986.

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CURRENT MARKET DATA

CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U as UF_6			per kg. U as UF_6		
Country (currency)	**This Month (Jun 30, 1986)**	**Last Month (May 31, 1986)**	**12 Months Ago (Jun 30, 1985)**	**This Month (Jun 30, 1986)**	**Last Month (May 31, 1986)**	**12 Months Ago (Jun 30, 1985)**
Australia (dollar)	2.68	2.50	2.40	5.92	5.52	5.29
Belgium (comm. franc)	81.01	84.31	98.34	178.59	185.87	216.80
Canada (dollar)	2.50	2.48	2.18	5.51	5.46	4.81
Finland (markka)	9.23	9.49	10.15	20.34	20.92	22.37
France (franc)	12.63	13.22	14.87	27.85	29.14	32.78
FRG (mark)	3.96	4.15	4.88	8.74	9.15	10.76
Italy (lira)	2,721	2,833	3,117	6,000	6,246	6,871
Japan (yen)	297.52	309.49	398.11	655.92	682.31	877.68
Netherlands (guilder)	4.46	4.65	5.51	9.83	10.25	12.16
South Africa (rand)	4.48	4.18	3.15	9.87	9.21	6.94
Spain (peseta)	254.06	262.97	279.43	560.10	579.74	616.03
Sweden (krona)	12.84	13.12	14.08	28.30	28.92	31.05
Switzerland (franc)	3.24	3.44	4.09	7.15	7.58	9.02
UK (pound)	1.18	1.21	1.24	2.59	2.67	2.72
US (dollar)	1.80	1.80	1.60	3.97	3.97	3.53

SWU VALUE AND UF_6 VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	**SWU Value delivery within one year (Jun 30, 1986)**	**UF_6 Value per kg.U in UF_6 This Month (Jun 30, 1986)**	**UF_6 Value per kg.U in UF_6 Last Month (May 31, 1986)**
Australia (dollar)	116.33	71.96	67.11
Belgium (comm. franc)	3,510	2,171	2,260
Canada (dollar)	108.29	66.99	66.44
Finland (markka)	399.80	247.31	254.35
France (franc)	547.37	338.60	354.26
FRG (mark)	171.73	106.23	111.28
Italy (lira)	117,932	72,951	75,948
Japan (yen)	12,893	7,975	8,296
Netherlands (guilder)	193.26	119.55	124.68
South Africa (rand)	194.03	120.02	111.95
Spain (peseta)	11,009	6,810	7,049
Sweden (krona)	556.35	344.15	351.68
Switzerland (franc)	140.52	86.92	92.13
UK (pound)	50.93	31.51	32.40
US (dollar)	78.00	48.25	48.25

[1] Calculated using currency exchange rates published in the *Wall Street Journal* on June 30, 1986.

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RECENT TRANSACTIONS[1]

Uranium Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price as Percent of Current Exchange or UF_6 Value	Seller	Buyer	Remarks
3753	1986	101-300	105	Producer	Utility	UF_6.
3751	1986	101-300	104	Trader	Utility	UF_6.
3750	1986	101-300	101	Producer	Trader	UF_6.
3746	1986	50-100	103	Trader	Utility	UF_6.

Enrichment Services
Secondary Market Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity[2] (thousands of SWUs)	Approximate Price[3] as Percent of Current SWU Value[4]	Seller	Buyer	SWU Origin	Remarks
3755	1986	101-300	96	Trader	Utility	DOE	

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[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] If tails assay is unknown or unspecified, Nuexco's calculation of SWU quantity assumes 0.20 w/o tails assay.

[3] Price is not normalized to 0.20% tails assay.

[4] Refers to SWU Value that corresponds to SWUs included in transaction. When prices and SWU values are expressed as discounts (e.g. X dollars less than DOE's USEC base price at time of delivery), the percentage refers to the ratio of the *discounts*, not the ratio of the prices.

[5] The notation *R* means that Nuexco either does not know, or that Nuexco has restricted that information to protect client confidentiality.

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CURRENT MARKET DATA

URANIUM SUPPLY
(June 30, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
2335	400	—	
2740	100	—	
2764*	260	—	UF_6
2765*	260	—	UF_6
2777	500	—	
2826*	190	—	UF_6
2889*	100	—	
2967*	100	—	
2989	40	—	
3010*	400	300 per year	
3023*	500	500	UF_6
3121	1,200	—	
2263	—	400 per year	1987 on
2625	—	500 per year	1987 on
2781	—	250 per year	1988-95
2927	—	220 per year	1987-90
TOTAL	4,050		
INACTIVE			
2297	200	200 per year	1988-89
2336	250	250 per year	1987-94
2389	75	75 per year	1987-90
2703	750	—	
2810*	195	175	UF_6
2813	30	—	
2853	65	—	
TOTAL:	1,565		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2871, 2933.

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URANIUM DEMAND
(June 30, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or long-term	Remarks
Inquiries to Purchase: ACTIVE			
2681	500	500 per year	UF_6 or U_3O_8; 1988
2733*	500	—	
2782*	600	700	1988
2928*	450	—	
2738	—	1,000	1989-on
2760	—	750 per year	1987-90
TOTAL:	2,050		
INACTIVE			
2661	250	250 per year	1986-87
2784	100	—	
2798	70	—	
2857*	—	300	1988-95
TOTAL:	420		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2217, 2507, 2839, 2845, 2850, 2943.

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CURRENT MARKET DATA

LOAN SUPPLY AND DEMAND
(June 30, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Within 1 Year	Beyond 1 Year	Remarks
Available for Loan:			
INACTIVE			
1938	2,000	—	UF_6
2036	500	—	
2667	800	—	
2920	2,000	—	
TOTAL:	5,300		

*New or revised since last month.

[1] Measured from the date of this Report.

Projects removed since last month: None.

No inquiries to borrow are reported this month.

CONVERSION SUPPLY AND DEMAND
(June 30, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U as UF_6) Within 3 Years	Beyond 3 Years	Remarks
Available for Sale:			
ACTIVE			
2849	550	500	1987-90
2859	750	750	
2988	400	500	
TOTAL:	1,700		
Inquiries to Purchase:			
ACTIVE			
2833	400	—	
2974	165	—	
TOTAL:	565		

*New or revised since last month.

[1] Measured from the date of this Report.

Projects removed since last month: None.

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SWU SUPPLY AND DEMAND
(June 30, 1986)

	Delivery Period[1] (Thousands of SWUs)		
Nuexco Project Number	Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
2571	—	55	1987
2855*	250	—	
2873	40	—	
2914	15	—	
2953	200	—	
TOTAL:	505		
INACTIVE			
2410A	340	—	
TOTAL:	340		
Inquiries to Purchase:			
ACTIVE			
2879	250	—	
TOTAL:	250		
INACTIVE			
2878	10	—	
TOTAL:	10		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes SWUs deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: None.

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ESSAY

HISTORY OF URANIUM IMPORT LIMITATIONS IN THE USA

The Atomic Energy Act [Section 161(v)] provides that enrichment of non-US origin uranium for use in US facilities shall be limited so "as to assure the maintenance of a viable domestic industry." Prior to 1974, on the basis of military and national security requirements, this language was interpreted by the US Atomic Energy Commission (AEC) as prohibiting *any* enrichment of non-US origin material for domestic end use. However, on November 27, 1973, the AEC published in the Federal Register notice of its intent to relax and eventually eliminate this prohibition in the manner illustrated in the following table:

Calendar Year	Percentage of Customer's Feed Which May Be of Non-US Origin
1977	10
1978	15
1979	20
1980	30
1981	40
1982	60
1983	80
1984 and beyond	100

This proposal was not finally adopted until October 25, 1974. The AEC, to insure a viable domestic uranium production industry, announced that it would monitor US utility purchases of non-US origin material with a view toward preventing domestic overdependence on foreign sources of supply. AEC considered the possibility of reimposing any partial or total embargo as remote, and the utilities were assured that if such a reimposition was deemed necessary, it would not affect agreements entered into prior to a reimposition.

The AEC's decision in 1974 to phase out the embargo was based on the prevailing perception that the rate of nuclear generating growth and associated uranium demand was capable of supporting a thriving domestic uranium industry, as well as absorbing a considerable volume of imported material. In 1974, most sources estimated US uranium requirements for 1985 to be nearly 100 million pounds U_3O_8. Actual US requirements for 1985 amounted to only about 30 million pounds.

From 1974 until 1979, few complaints were voiced about the US policies regarding uranium imports. However, in late 1979, following the Three Mile Island accident and the onset of a number of nuclear plant cancellations, uranium prices began to drop. The price fell sharply throughout 1980 in the wake of massive inventory liquidations. In the fall of 1980, Senator Pete Domenici (R, New Mexico) introduced legislation designed to amend DOE's 1981 appropriations bill to limit US utility use of non-US origin uranium. The attempt failed, but Domenici tried again in 1982, proposing that not more than 20 percent of the uranium used in US reactors could be of non-US origin. However, neither that 20 percent limit nor a proposed compromise limit of 37.5 percent gained enough Congressional support to become law.

In 1983, Congress passed legislation that provided for studies, reports, and a framework for action in the event uranium imports exceeded or were expected to exceed 37.5 percent in any two consecutive years. While most US producers regarded this legislation to be a victory at the time, it ultimately provided them little relief. Principally because of the Reagan administration's emphasis on free trade and reluctance to support embargo initiatives of any type, the legislation had little influence on US uranium import policies.

DOE's promulgation of the USEC in 1984 was in essence the final defeat for many US producers. As a requirements-type contract, the USEC reduced and deferred uranium demand that had been locked in under the Adjustable Fixed-Commitment contract (AFC), the previous form of DOE enrichment contract. Moreover, the USEC included a surcharge for specifying tails assays higher than 0.20 percent U_{235}, making the use of higher tails assays (requiring more uranium and less SWU) more expensive. Finally, as a consequence of individual negotiations with DOE, a number of US utilities obtained the right to use existing inventories of enriched product, further delaying the need for new uranium supplies.

During 1984, it appears that DOE was preoccupied with developing enrichment policies to protect its market share, which was threatened by foreign enrichment suppliers and an active secondary market for enrichment services. Despite a series of meetings with DOE during 1984 and the threat of a lawsuit, over which DOE publicly expressed little concern, US producers were unable to obtain any relief satisfactory to them. Finally, three producers filed the five-count lawsuit in December 1984.

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US URANIUM PRODUCTION SITUATION

Introduction

Uranium production in the USA has declined sharply in the last five years, from a level of almost 44 million pounds U_3O_8 in 1980 to only 11 million pounds in 1985, a decrease of 75 percent. That downward trend may be reversed in 1986. Despite the fact that the number of active US producers has declined since January, Nuexco expects 1986 US production to exceed the 1985 level by two to three million pounds U_3O_8. Production in 1987 may again decrease if projected production cuts are implemented. The decreasing trend in production reflects well-known circumstances affecting the domestic industry. Generally, US producers are faced with high operating costs, low-grade ores, low concentrate prices, limited long-term market opportunities, strong foreign competition, and the uncertainties of site reclamation. Under free-market conditions, near-term relief from any one of those circumstances would be unlikely; relief from the combination of unfavorable conditions would be virtually impossible. In short, most US producers exist in an environment that is unfavorable to mining and processing uranium and is likely to remain so, absent government assistance.

Nevertheless, many producers have maintained standby status for specific projects, ready to resume operations under more favorable marketing conditions; other companies are exploring for new ore deposits or filing for permits required to start new mining operations. However, economics will be the final determinant of project success in the US industry as long as free-market conditions prevail.

As a result of the recent judicial ruling or a possible legislative or procedural mandate, US utilities might eventually be required to purchase additional domestic uranium. At present, that is far from certain. Most US producers undoubtedly will respond to such opportunities, but many may not be able to do so in a short period of time. It could take several years for those producers to reestablish their positions as reliable suppliers.

Conventional Producers

Five conventional projects were in operation as of June 1986. Three of those had also been in operation in 1985 — Pathfinder Mines Corporation's mine and mill at Shirley Basin, Wyoming, Rio Algom Corporation's mine and mill at La Sal, Utah and the UMETCO/Energy Fuels mill at Blanding, Utah. Pathfinder and Rio Algom have been operating continuously for the past few years, milling ore from mines adjacent to their processing plants. Rio Algom recently began bolstering its ore supply with ore purchased from six independent miners operating near the La Sal mill.

The UMETCO/Energy Fuels Nuclear mill was restarted in October 1985 in order to process ore from three mines operated by Energy Fuels in the Arizona Strip district; Energy Fuels is also buying custom ore from some independent miners. The company estimates U_3O_8 production for 1986 will exceed five million pounds U_3O_8, and that is the chief reason that total US production for 1986 should surpass the 1985 level.

Cotter Corporation's mill at Cañon City, Colorado, restarted in February 1986, and Chevron Resources Company's mill at Hobson, Texas restarted in May. Cotter is currently processing stockpiled ore from the Schwartzwalder mine near Golden, Colorado. The mill is operating at an approximate rate of 400 tons per day (about one-third of rated capacity) during each work period. Cotter has no immediate plans to resume mining its sandstone resources in the Uravan district of western Colorado.

When Chevron restarted the Hobson mill, following an 11-month closure, it began transporting ore 960 miles by rail from the Mount Taylor mine near Grants, New Mexico to supply the mill. (Mining of the Panna Maria deposits ceased in early 1985.) Ore from Mount Taylor averages about 0.48 percent U_3O_8 and requires longer leach time than Panna Maria ores; thus, the milling rate is presently about 400 tons per day. (Nominal mill capacity is 2,000 tons per day.)

Chevron recently acquired an option on the Rhode Ranch deposit, located about 75 miles southwest of Hobson, Texas. The deposit has estimated reserves of 6.5 million pounds that could be mined at a grade of about 0.25 percent. The ore is only 30 to 100 feet below the surface, so the deposit would be mined using open-pit methods. If Chevron decides to proceed with the Rhode Ranch project, the proximity of the Hobson mill will facilitate ore processing.

In the USA, the continued availability of uranium extracted by conventional mining processes is somewhat uncertain. Two mills presently operating may not be operating next year. The Rio Algom project is scheduled for closure in September or October 1986. The project represents the last stable source of uranium production in the Moab/La Sal area of Utah. The Rio Algom closure will undoubtedly hinder efforts to revive the local industry in the event of a strengthening of the domestic industry.

The UMETCO/Energy Fuels mill is tentatively scheduled to close in the second quarter of 1987. Stockpiled ore from mines in the Arizona Strip will be depleted at that time. New stockpiles will be built up to about 80,000 tons before another milling phase is considered. Energy Fuels may have three new mines operating in the Arizona Strip district when the mill reopens (the Pine Nut and Kanab North deposits have received mining permits, and the Canyon deposit is in the process of acquiring permits.) If both the Rio Algom mill and the UMETCO/Energy Fuels mill close by early next year, there will be no processing

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plants operating in the Uravan Mineral Belt for the first time since 1950.

The Cotter mill may operate only during the warm weather months throughout 1987. The length of operation probably will depend on the rate that the Schwartzwalder ore is stockpiled and the uranium fuel requirements of Commonwealth Edison Company, its parent company. The mill can operate six or seven months of the year by using Schwartzwalder ore to produce 600,000 to 700,000 pounds U_3O_8. In the event Commonwealth Edison's requirements exceed that amount, they will have the option of buying uranium in the market or renewing mining in the Uravan district to augment the Schwartzwalder ore supply. The latter option is unlikely without a significant increase in the price of uranium.

The renovation of pathfinder's Lucky Mc mill in Gas Hills, Wyoming, underway since March 1985, is scheduled for completion at the end of 1986. It is being modernized to handle additional ore from the Lucky Mc open pit, as well as ore from adjacent deposits that may be developed in the future. The mill has a daily capacity of 2,500 tons; it probably will operate at about half that capacity depending on the availability of new market opportunities.

The five conventional mills currently operating have a combined daily capacity of 8,250 tons ore; however, they are operating at only about half that capacity, producing slightly more than five million pounds in 1985. In the event of a sharp increase in the demand for US-origin natural uranium, the five mills could rapidly increase production by as much as 75 percent, to approximately nine million pounds annually. The increase in market price required to induce such a production increase varies from project to project. Generally, producers would have to be assured of obtaining contract prices in the range of at least $23 to $25 per pound U_3O_8 in order to stimulate near-capacity production rates. (In general, US output from conventional sources is often delivered under old contract prices which are considerably higher than those contained in present-day contracts. Certain high-priced contracts extend into the mid-1990s.)

There are perhaps two other mills not currently operating that might start producing if the owners were assured of obtaining contract prices of $23 to $25 per pound. The two mills represent an annual production potential of nearly three million pounds U_3O_8. In addition, there are at least three additional mills that may be restarted if contract prices increased to the $26 to $29 per pound level. They would add a maximum daily capacity of about three thousand tons ore, and approximately two million pounds to annual production. In the unlikely event that contract prices rose to $30 per pound or more in the intermediate term, three more mills might be restarted. Their combined capacity could result in additional production of about six to seven million pounds U_3O_8 per year. However, during the time required to make the decision and resume a reasonable production level, a process that could take up to two years, many of the favorable conditions that existed in the industry may have changed.

The above possibilities are purely speculative. New production can only be justified if suitable ore reserves, in terms of uranium content, quantity and accessibility, are available. Generally, US mill head grades have averaged 0.11 percent annually since 1979. Thus, the average grade of undeveloped reserves must be considerably higher to be mined in the present environment. In addition, securing long-term delivery contracts is vital to pre-startup planning. It is unlikely that many companies would consider expanding or restarting without one or more long-term contracts secured. Each project is also challenged by new operating regulations and conditions for site reclamation. For these reasons, some companies involved in conventional projects may choose not to participate in another surge in development activity even if prices rise substantially.

Non-Conventional Producers

Solution Mining — The South Texas district remains the most active area for solution mining, or in-situ leach mining (ISL). At present only five production centers are operating, half as many as in 1982. Everest Minerals Corporation is producing 500,000 pounds annually at the Mt. Lucas property in southern Live Oak County; the Hobson and Los Palmas projects are in restoration. The US Steel/Niagara Mohawk Clay West property located at George West is expected to produce approximately 560,000 pounds in 1986; US Steel's adjacent Burns Ranch property is in restoration and may produce about 30,000 pounds this year. Mobil might produce about 250,000 to 300,000 pounds from now to the end of 1986 at its El Mesquite property near Bruni. Intercontinental Energy Corporation is starting production at the Lamprecht property in central Live Oak County. Output is estimated at 35,000 to 50,000 pounds in 1986, increasing to 100,000 pounds in 1987.

The solution mining activity at Crow Butte, Nebraska is proceeding. Ferret Exploration Company has assumed full control of the project and is ready to start the 100 gallon-per-minute ISL pilot plant for the initial field test. The demonstration leach/restoration project will be complete in approximately 18 months. Successful test results should lead to commercial production, but the schedule is indefinite.

Other important pre-production ISL test work is in progress by Everest Minerals Corporation on the Highland property in the south Powder River Basin of Wyoming. Everest anticipates beginning commercial production by late 1987. Also in the Powder River Basin, Malapai Resources is preparing for initial pilot testing of the Willow Creek deposit on the Christensen

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Ranch property. Malapai has tentatively scheduled commercial production for late 1987 or early 1988. Recently, the only active production in the Powder River Basin was at the Bill Smith mine, where Kerr McGee produced about 165,000 pounds from mine water and an ISL test area.

Seven companies produced approximately 2.2 million pounds U_3O_8 by solution mining in 1985. Of that total, at least 225,000 pounds were produced from mine water in the Ambrosia Lake district of New Mexico. Total production by solution methods will decline about 250,000 pounds in 1986 due primarily to decreasing production at Clay West. A significant increase in ISL production is not expected until the end of 1987. Because solution mining is generally less capital intensive and offers environmental advantages over conventional mining, solution mining projects are gaining favor, especially among small companies. The new solution mines under consideration could increase ISL production to four or five million pounds by the end of 1988.

By-Product Operations — Most by-product uranium comes from phosphoric acid. Three such operations produced three million pounds U_3O_8 in 1985. International Minerals & Chemical Corporation (IMC) produced 1.8 million pounds at Bartow, Plant City and New Wales, Florida. Freeport Uranium Recovery Company produced 1.1 million pounds at plants located in Sunshine Bridge and Uncle Sam, Louisiana. That total is likely to remain fairly constant through 1986 and 1987 because much of the output is sold under long-term delivery contracts.

The joint venture of Earth Sciences Resources Ltd. and Urangesellschaft mbH (UG) produced 120,000 pounds from phosphoric acid operations. The phosphate rock is mined in Idaho and processed at an acid plant near Calgary, Alberta, Canada. All output is delivered to UG.

Heap leach production is considered a by-product recovery method. The project at Bingham Canyon, Utah is the only project of its kind in the USA. Wyoming Mineral Corporation has contracted to recover uranium from solutions passed through the waste dumps. Approximately 60,000 pounds were produced in 1985, but the plant has been closed since mid-1985. Additional production by heap leaching is not likely to occur under present industry circumstances.

Conclusions

If necessary, active conventional and solution mining operations could increase output in a short time to meet a modest increase in demand of about four million pounds over 1985 production. New activity in solution mining projects, which are usually less capital intensive than conventional projects, may surpass increases at conventional operations. Some conventional producers may also turn to lower-cost solution mining (extraction from natural or induced mine water) to increase output. An extensive effort (operation at design capacity) could produce up to seven million pounds more. Thus, under present conditions and without significant expansion, the US uranium industry could supply approximately 18 million pounds U_3O_8 annually. Nevertheless, the important consideration is the fact that contract prices must exceed production costs before operations that are currently shut down will resume production. It remains to be seen whether political events will create significant additional demand for US uranium.

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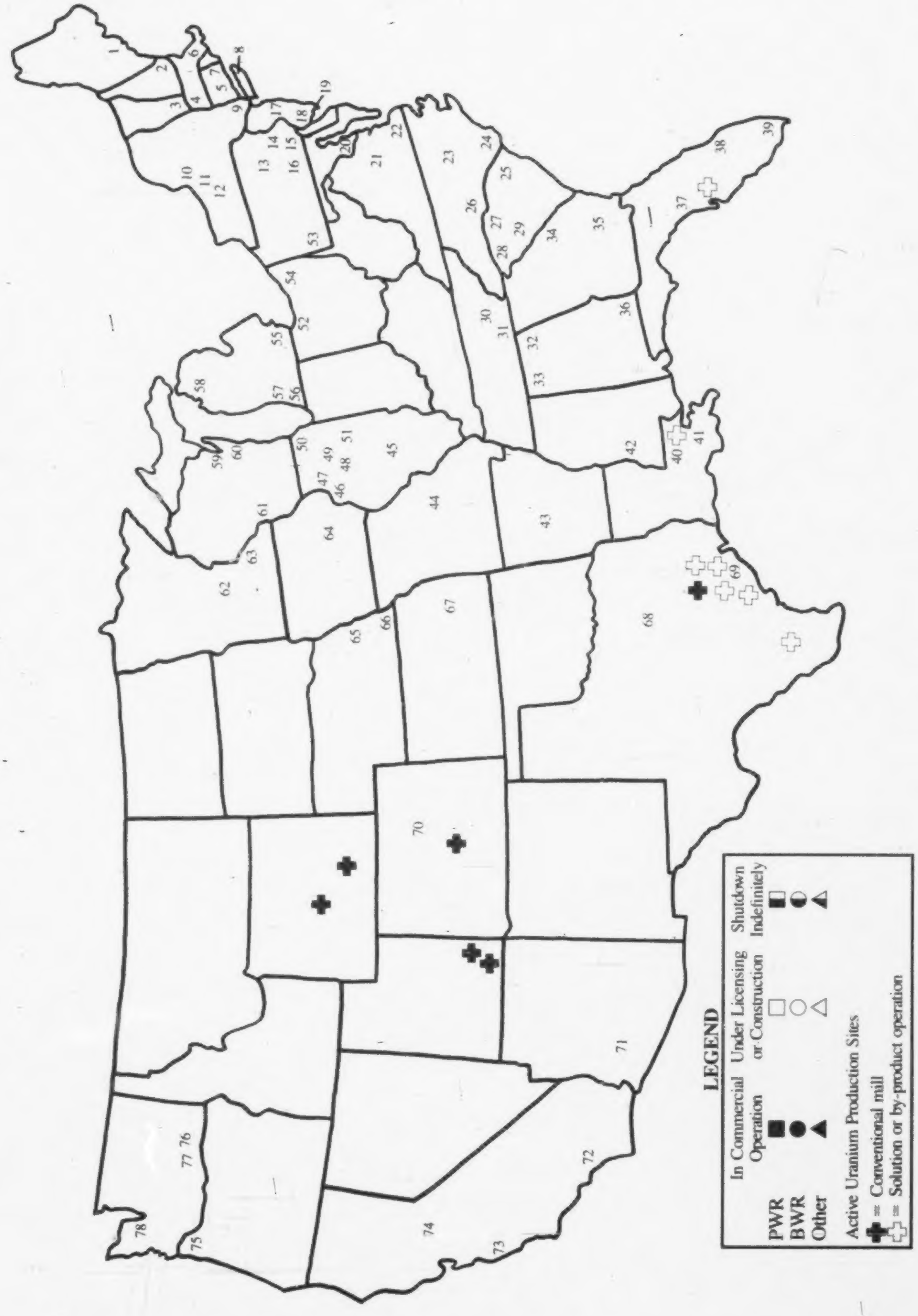
Figure 1

MAP OF U.S. NUCLEAR POWER STATIONS AND ACTIVE URANIUM PRODUCTION SITES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78
LEGEND
In Commercial Operation
Under Licensing or Construction
Shutdown Indefinitely
PWR ■ □
BWR ● ○
Other ▲ △
Active Uranium Production Sites
✚ = Conventional mill
✜ = Solution or by-product operation

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Table 2
COMMERCIAL NUCLEAR POWER STATIONS IN THE USA

Fuel Buyer	Station	Units
1. Yankee Atomic Group (1)	Maine Yankee	■
2. Yankee Atomic Group (1)	Seabrook	□ □
3. Yankee Atomic Group (1)	Vermont Yankee	●
4. Yankee Atomic Group (1)	Yankee Rowe	■
5. Yankee Atomic Group (1)	Haddam Neck	■
6. Boston Edison Co.	Pilgrim	●
7. Northeast Utilities	Millstone	● ■ □
8. Long Island Lighting Co.	Shoreham	○
9. Consolidated Edison Co. New York	Indian Point 2	■
New York Power Authority	Indian Point 3	■
10. New York Power Authority	James A. Fitzpatrick	●
11. Niagara Mohawk Power Corp.	Nine Mile Point	● ○
12. Rochester Gas and Electric Corp.	Robert E. Ginna	■
13. Pennsylvania Power and Light Co.	Susquehanna	● ●
14. Philadelphia Electric Co.	Limerick	● ○
15. Philadelphia Electric Co.	Peach Bottom	● ●
16. GPU Nuclear Corp.	Three Mile Island	■ ◧
17. GPU Nuclear Corp.	Oyster Creek	●
18. Public Service Electric and Gas	Salem	■ ■
19. Public Service Electric and Gas	Hope Creek	○
20. Baltimore Gas and Electric Co.	Calvert Cliffs	■ ■
21. Virginia Electric Power Co.	North Anna	■ ■
22. Virginia Electric Power Co.	Surry	■ ■
23. Carolina Power and Light Co.	Shearon Harris	□
24. Carolina Power and Light Co.	Brunswick	● ●
25. Carolina Power and Light Co.	H.B. Robinson	■
26. Duke Power Co.	William McGuire	■ ■
27. Duke Power Co.	Catawba	■ □
28. Duke Power Co.	Oconee	■ ■ ■
29. South Carolina Electric and Gas	Summer	■
30. Tennessee Valley Authority	Sequoyah	◧ ◧
31. Tennessee Valley Authority	Watts Bar	□ □
32. Tennessee Valley Authority	Bellefonte	□ □
33. Tennessee Valley Authority	Browns Ferry	◐ ◐ ◐
34. Southern Company Services	Alvin W. Vogtle	□ □
35. Southern Company Services	Edwin I. Hatch	● ●
36. Southern Company Services	Joseph M. Farley	■ ■
37. Florida Power Corp.	Crystal River	■
38. Florida Power and Light Co.	St. Lucie	■ ■
39. Florida Power and Light Co.	Turkey Point	■ ■
40. Gulf States Utilities Co.	River Bend	○
41. Middle South Utilities	Waterford	■
42. Middle South Utilities	Grand Gulf	● ○
43. Middle South Utilities	Arkansas Nuclear	■ ■
44. Union Electric Co.	Callaway	■
45. Illinois Power Co.	Clinton	○
46. Commonwealth Edison Co.	Quad Cities	● ●
47. Commonwealth Edison Co.	Byron	■ □
48. Commonwealth Edison Co.	La Salle	● ●
49. Commonwealth Edison Co.	Dresden	● ●
50. Commonwealth Edison Co.	Zion	■ ■
51. Commonwealth Edison Co.	Braidwood	□ □
52. CAPCO (2)	Davis-Besse	■
53. CAPCO (2)	Beaver Valley	■ □
54. CAPCO (2)	Perry	○ ○
55. Detroit Edison Co.	Fermi	○
56. American Electric Power Co.	Cook	■ ■
57. Consumers Power Co.	Palisades	■
58. Consumers Power Co.	Big Rock Point	●
59. Wisconsin Public Service Corp.	Kewaunee	■
60. Wisconsin Electric Power Co.	Point Beach	■ ■
61. Dairyland Power Cooperative	La Crosse	●
62. Northern States Power Co.	Monticello	●
63. Northern States Power Co.	Prairie Island	■ ■
64. Iowa Electric Light and Power Co.	Duane Arnold	●
65. Omaha Public Power District	Fort Calhoun	■
66. Nebraska Public Power District	Cooper	●
67. Kansas Gas and Electric Co.	Wolf Creek	■
68. Texas Utilities Electric Co.	Comanche Peak	□ □
69. Houston Lighting and Power Co.	South Texas Project	□ □
70. Public Service Co. of Colorado	Fort St. Vrain	◭
71. Arizona Public Service Co.	Palo Verde	■ □ □
72. Southern California Edison Co.	San Onofre	■ ■ ■
73. Pacific Gas and Electric Co.	Diablo Canyon	■ ■
74. Sacramento Municipal Utility District	Rancho Seco	■
75. Portland General Electric Co.	Trojan	■
76. U.S. Department of Energy	Hanford	▲
77. WPPSS	WNP 1 and 2	● □
78. WPPSS	WNP 3	□

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(1) Consists of Maine Yankee Atomic Power Company, Vermont Yankee Nuclear Power Corporation, Public Service Company of New Hampshire, Yankee Atomic Electric Company.

(2) CAPCO = Central Area Power Coordinating Group

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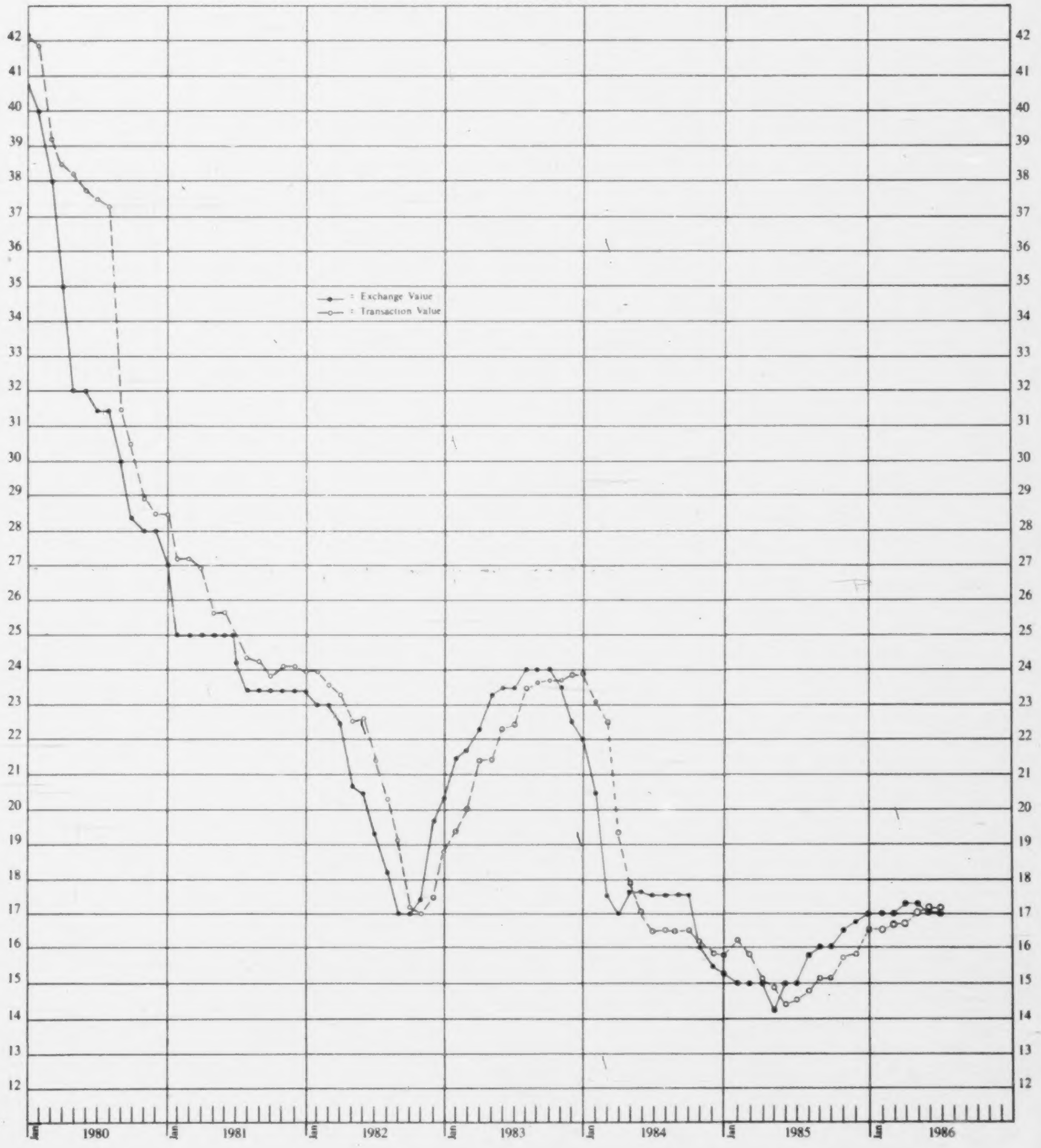
HISTORICAL MARKET DATA

EXCHANGE AND TRANSACTION VALUES SINCE JANUARY 1980

Determined as of the last day of the month indicated



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HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	32.50	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	**17.00**						

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.15	**17.20**						

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U in UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.80	1.90	1.80	**1.80**						

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GOVERNMENT STATISTICS

AUSTRALIA

	Price Index of Materials Used in Manufacturing Industry — All Groups[1] (1984 = 100)	Award Rates of Pay Indexes Australia — Adult Males In Mining Wage Earners, Weekly Rates[2] (1976 = 100)
1975 Avg.	150.4	132.6
1976 Avg.	168.4	160.9
1977 Avg.	192.0	179.0
1978 Avg.[3] [4]	198.5	190.0
1979 Avg.	248.8	127.9
1980 Avg.	321.8	140.8
1981 Avg.	355.3	154.1
1982 Avg.[5]	368.6	174.9
1983 Avg.	401.6	181.8
FY84 Avg.[6]	95.3	—
FY85 Avg.[6]	100.0	—
Jan 1985	97.0	197.8
Feb 1985	98.6	197.8
Mar 1985	102.1	197.8
Apr 1985	104.4	202.8
May 1985	107.6	202.8
Jun 1985	108.7	202.8
Jul 1985	111.1	202.8
Aug 1985	110.5	202.8
Sep 1985	108.9	202.8
Oct 1985	108.7	202.8
Nov 1985	109.6	210.2
Dec 1985	110.2	210.3
Jan 1986	109.8	210.3
Feb 1986	108.9P	210.3
Mar 1986	99.7P	210.3
Apr 1986	—	210.3

P = Preliminary R = Revised since last month

[1] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0). The basis of this index was revised to 1984 = 100. The previous index was 1969 = 100.

[2] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

[3] Monthly data for 1970-78 appear on pages 4.7 and 4.8 of Report 138.

[4] Annual averages prior to 1979 reflect index base no longer in use.

[5] Monthly data for 1979-82 appear on page 35 of Report 184.

[6] Annual averages are for financial year ending June 30.

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CANADA

	Industry Selling Price Index: All Commodities[1] (1981 = 100)	Wage-earner Data: Average Hourly Earnings (C$)[2] Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells[3] (SIC 051-099)	Primary Non-ferrous Metal Industries[4] (SIC 296)	Primary Non-ferrous Metal Industries[4] (SIC 298)	Chemicals and Chemical Products[5] (SIC 372-379)
1979 Avg.[6]	217.9	—	9.60	9.66	—	—	7.67
1980 Avg.	247.2	—	10.58	10.80	—	—	8.50
1981 Avg.	288.7	—	12.02	12.23	—	—	9.53
1982 Avg.[7]	288.8	—	13.74	13.92	—	—	10.63
1983 Avg.	298.8	—	—	14.30	—	—	11.17
1984 Avg.	310.9	17.88	—	15.07	12.28	10.49	11.76
Jan 1985	117.5	18.05	16.13	15.60	12.32	10.80	12.04
Feb 1985	117.7	18.78	16.41	15.68	12.52	11.05	12.06
Mar 1985	118.4	18.24	16.21	15.57	12.44	10.97	12.02
Apr 1985	118.3	18.63	16.44	15.80	12.81	11.23	12.04
May 1985	118.6	19.41	16.51	15.63	12.76	11.25	12.15
Jun 1985	118.6	18.49	16.20	15.49	12.89	11.14	12.14
Jul 1985	118.6	18.14	16.27	15.41	12.96	11.17	12.13
Aug 1985	118.4	17.07	16.03	15.30	12.97	11.31	12.19
Sep 1985	118.6	18.53	16.55	15.72	12.95	11.39	12.26
Oct 1985	118.9	18.74	16.51	15.70	13.14	11.53	12.33
Nov 1985	119.1	19.05	16.66	15.88	12.76	11.32	12.49
Dec 1985	119.7	19.07	16.57	16.01	12.51	11.09	12.59
Jan 1986	120.6	18.15	16.22	15.86	13.11	11.48	12.52
Feb 1986	120.5	19.52	16.57	15.99	13.20	11.59	12.45
Mar 1986	120.0	19.04	16.57R	15.99R	13.11R	11.59R	12.54R
Apr 1986	119.7	19.38P	16.65P	15.93P	13.08P	11.59P	12.58P

P = Preliminary R = Revised since last month

[1] Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Index prior to 1985, 1971 = 100.

[2] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours" (Catalogue 72-002).

[3] Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

[4] Beginning with the April 1983 figure, Primary Metal Industries, non-ferrous is split into SIC 296 and SIC 298.

[5] Chemical and Chemical Products prior to April 1983 was SIC 370-379. The new series is from a new survey which includes all companies and is based on a 1970 classification. The old survey only included companies of 20 employees or more.

[6] Monthly ISPI for 1977 and 1978 appear on page 4.10 of Report 138, and monthly wage-earner data for 1973-78 appear on page 4.11 of Report 138.

[7] Monthly data for 1979-1982 appear on page 37 of Report 184. On that page, the wage earner index entitled "Metal Mining, Including Milling (SIC 050-099)" should read "Total Mining (SIC 051-099)."

[8] Beginning with the March 1983 figure, Wage Earner Data are based on a census of all companies employing 200 or more wage earners, *plus* a random survey of companies employing fewer than 200 wage earners. Prior to March 1983 only companies employing 200 or more wage earners are included in the Wage Earner Data.

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GOVERNMENT STATISTICS

REPUBLIC OF SOUTH AFRICA

		Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1]	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100)[2]	Consumer Price Index[3] (1980 = 100)[4]	Producer Price Index All Groups[5] (1980 = 100)	Total Employment in Mining and Quarrying (Code 35)[6]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[6]
1975	Avg.	16.71	—	157.2	100.0	639,473	1,003,617
1976	Avg.	19.30	—	174.7	115.1	671,240	1,212,983
1977	Avg.	23.87	—	194.4	130.0	712,006	1,420,670
1978	Avg.	27.14	—	137.2	142.7	664,571	1,537,169
1979	Avg.[7]	30.18	—	155.3	164.5	692,209	1,830,632
1980	Avg.[8]	35.53	—	176.7	192.1	714,379	2,279,615
1981	Avg.	41.89	—	206.5	218.3	728,506	2,820,505
1982	Avg.[9]	47.25	104.2	233.5	248.7	707,552	3,246,071
1983	Avg.	51.87	115.0	262.2	274.8	696,579	3,644,772
1984	Avg.	58.95	130.3	292.8	297.9	712,080	4,196,764
Jan	1985	—	—	177.1	166.6	711,366	376,777
Feb	1985	—	—	182.8	171.3	727,932	361,823
Mar	1985	64.48	142.4	183.6	173.0	708,809	371,380
Apr	1985	—	—	187.4	174.0	724,187	369,005
May	1985	—	—	189.5	177.7	708,085	373,478
Jun	1985	67.42	148.9	191.9	179.2	724,587	395,543
Jul	1985	—	—	193.6	180.7	738,228	419,106
Aug	1985	—	—	195.6	183.2	734,121	416,777
Sep	1985	70.47	155.3	197.8	184.8	732,836	419,883
Oct	1985	—	—	200.8	188.1	720,071	401,448
Nov	1985	—	—	203.4	196.0	750,049	432,996
Dec	1985	72.43	160.1	207.4	199.4	741,372	425,261
Jan	1986	—	—	213.8	203.6	744,070	449,513R
Feb	1986	—	—	215.8	206.9	754,458R	438,562R
Mar	1986	75.76	167.8	218.3	206.9	760,932R	446,475R
Apr	1986	—	—	222.2	208.9	—	—
May	1986	—	—	222.6	—	—	—

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[1] Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly.

[2] Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

[3] Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."

[4] The basis for calculation prior to January 1985, 1975 = 100. For annual averages prior to 1978, April 1970 = 100.

[5] Previously known as the Wholesale Price Index, now the Producer Price Index. The computation remains the same. The basis for calculation prior to January 1985, 1975 = 100.

[6] Bulletin of Statistics, Department of Statistics, Pretoria.

[7] Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 4.9 of Report 140.

[8] Monthly data for Codes 35 and 40, 1977-1980, appear on page 28 of Report 157.

[9] Monthly data for 1979-82 appear on page 39 of Report 184.

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UNITED STATES

	Producer Price Index[1]		Consumer Price Index[2] (1967 = 100)	GNP Implicit Price Deflator[3,4] (1982 = 100)	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[5]			
	Industrial Commodities (1967 = 100)	All Commodities (1967 = 100)			Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980 Avg.[6]	274.8	268.8	246.8	178.64	10.26	10.63	8.30	6.94
1981 Avg.	304.1	293.4	272.4	195.51	11.55	11.98	9.12	7.62
1982 Avg.[7]	312.3	299.3	289.1	207.15	12.33	12.94	9.96	8.21
1983 Avg.	315.8	303.1	298.4	215.63	12.57	13.43	10.59	8.65
1984 Avg.	322.6	310.3	311.1	108.1	13.05	13.43	11.08	9.04
Jan 1985	322.9	309.5	316.1	—	13.29	13.70	11.39	9.33
Feb 1985	322.5	309.2	317.4	—	13.30	13.73	11.39	9.33
Mar 1985	322.6	308.7	318.8	110.4	13.29	13.95	11.37	9.39
Apr 1985	323.8	309.3	320.1	—	13.43	13.63R	11.47R	9.40
May 1985	325.3	309.8	321.3	—	13.24	13.60R	11.44R	9.39
Jun 1985	324.8	309.2	322.3	111.3	13.23	13.68R	11.51R	9.46
Jul 1985	324.4	309.0	322.8	—	13.45	13.83R	11.59R	9.47
Aug 1985	323.7	307.3	323.5	—	13.55	13.71R	11.60R	9.50
Sep 1985	322.3	305.5	324.5	112.1	13.44	13.68R	11.65R	9.54R
Oct 1985	324.2	307.9	325.5	—	13.49	13.66R	11.70R	9.55R
Nov 1985	324.7	309.5	326.6	—	13.49	13.97R	11.80R	9.61
Dec 1985	325.1	310.2	327.4	113.0	13.43	13.81R	11.85R	9.68
Jan 1986	233.8R	308.9R	328.4	—	13.40	13.69R	11.86R	9.60R
Feb 1986	319.4	304.7	327.5	—	13.44	13.82R	11.81R	9.60
Mar 1986	314.0	300.3	326.0	113.7	13.38R	13.93R	11.78R	9.62R
Apr 1986	311.3	297.9	325.3	—	13.50P	13.28P	11.83P	9.61P
May 1986	311.7	299.2	326.3	—	—	—	11.85P	9.63P
Jun 1986	—	—	—	113.8	—	—	—	—

P = Preliminary R = Revised since last month

[1] US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

[2] US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items.

[3] US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

[4] The basis for calculation of this index was revised to 1982 = 100. 1984 and 1985 figures have been adjusted to that basis. The basis for calculation prior to 1984, 1972 = 100.

[5] US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for 1977-1978 are adjusted to the March 1979 benchmark. Data for January 1979 and beyond are adjusted to the March 1980 benchmark.

[6] Monthly data 1970-1978 for Producer Price Index-Industrial Commodities, Consumer Price Index, and Employment and Earnings SIC codes 10, 333, and 28, and quarterly data for GNP Implicit Price Deflator appear on pages 4.6-4.8 of Report 139.
Monthly data 1977-1978 for Employment and Earnings SIC Codes 10, 333, and 28 appear on page 33 of Report 147.
Monthly data 1970-1978 for Employment and Earnings SIC Code 36 appear on page 23 of Report 154.
Monthly data 1977-1980 for Producer Price Index-All Commodities, appear on page 21 of Nuexco Report 158.

[7] Monthly data 1979-1982 for all listed indices appear on page 41 of Report 184.

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NUEXCO

REPRESENTATIVES AND CONSULTANTS

JAPAN

Kazy Yokota
Japan Tech Services
Ohkura Building (3F)
1-4-10 Shiba Daimon
Minato-ku, Tokyo, Japan
Telephone: (81-3) 431-6031, 6025
Telecopy: (81-3) 434-6674
Telex: 242-5060 (JATECH J)

SOUTH AFRICA

Chris I. Von Christierson
Southern Prospecting (Pty) Limited
P.O. Box 61409
Marshalltown 2107
Republic of South Africa
Street Address:
10th Floor
Eagle Star House
70 Fox Street
Johannesburg 2001
Telephone: (27-11) 838-1868
(27-11) 834-4211
Telecopy: (27-11) 834-3148
Telex: 4-89878 SA

TAIWAN

Edward Bee
Bee & Liang Company, Ltd.
14 FL Universal Business Center
NO. 663, Tun Hwa South Road
P.O. Box 1396
Taipei, Taiwan R.O.C.
Telephone: (886-2) 704-9630
TWX: 785-11570 (BEELIANG)

UNITED STATES

Harold C. Lindberg
83-A Hardee Lane
Whispering Pines, N.C. 28327
Telephone: (919) 949-3622

M. Jerry Reaves
Suite 500
Seven Piedmont Center
Atlanta, Georgia 30305
Telephone: (404) 262-7375

SPECIAL CONSULTANTS

George J. Stathakis
International Investment Banking

James C. C. Stewart
U.K. Nuclear Industry

W. Bryan Webster
International Business Development

J. Robert Wolcott
International Business Development

NUEXCO

NUEXCO REPORT 215 FIGURES OF THE MONTH (June 30, 1986)	This Month (Report 215)	Last Month (Report 214)	12 Months Ago (Report 203)
Exchange Value[1]	17.00	17.00	15.00
Transaction Value[1]	17.20	17.15	14.60
UF_6 Value[2]	48.25	48.25	42.50
Loan Rate[3]	4%	4%	5%
Conversion Value[4]	1.80	1.80	1.60
Near-Term Uranium Supply[5]	4.1	4.2	3.5
Near-Term Uranium Demand[6]	2.1	1.0	1.3
Near-Term Supply-Demand Ratio	2.0	4.3	2.7
Recent Uranium Sales:			
Number of Transactions[7]	4	6	8
Quantity of Material[8]	0.6	1.2	1.5
Nuexco SWU Value:[9]			
at 0.3 tails assay and delivery within one year	78	75	—
USDOE SWU Prices:			
USEC	125.00[10]	125.00[10]	135.00
AFC	153.00[11]	153.00[11]	153.00[11]
Requirements	157.00[11]	157.00[11]	157.00[11]
Market Value of Enriched UF_6[12,13]:			
2.5 w/o U_{235}	457	450	452
3.0 w/o U_{235}	585	575	582
3.5 w/o U_{235}	715	702	714
4.0 w/o U_{235}	847	831	849

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[1] US $ per pound U_3O_8 equivalent.

[2] US $ per kilogram U as UF_6.

[3] Per annum.

[4] US $ per pound U as UF_6.

[5] Active inquiries to sell, for delivery within 12 months after contract signing (millions of pounds U_3O_8).

[6] Active inquiries to purchase, for delivery within 12 months after contract signing (millions of pounds U_3O_8).

[7] Uranium sales only; does not include loans, conversion, or SWU transactions.

[8] Millions of pounds U_3O_8, equivalent.

[9] US $ per SWU.

[10] Effective 10/1/85.

[11] Effective 10/1/84.

[12] Calculated using the Nuexco Exchange Value, Conversion Value, and 0.30 percent tails assay. From 4/30/85 to 11/30/85, calculations used in the Nuexco SWU Value for DOE origin and delivery by the end of FY86. As of 12/31/85, calculations use the SWU Value for delivery within one year.

[13] US $ per KgU as UF_6, rounded to the nearest $.

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EXECUTIVE SUMMARY
REPORT 215
(All data as of June 30, 1986)

Exchange Value
$17.00, unchanged

The **Exchange Value** is **$17.00** per pound U_3O_8, unchanged since last month.

UF_6 Value
$48.25, unchanged

The **UF_6 Value** is **$48.25** per kilogram U as UF_6, unchanged since last month.

Transactions

Four recent natural uranium sales are reported, involving approximately 600 thousand pounds equivalent U_3O_8. All of the sales involved natural UF_6 for spot or near-term delivery, and all met the conditions for inclusion in the Transaction Value.

Supply-Demand Ratio
fell to 2.0:1

Active spot and near-term **uranium supply** amounts to **4.1 million** pounds U_3O_8 equivalent, down 165 thousand pounds since last month. Active spot and near-term **uranium demand** totals **2.1 million** pounds, up 1.1 million pounds. The spot and near-term **supply-demand ratio** fell to **2.0:1.**

Transaction Value
$17.20, up $0.05

The **Transaction Value** is **$17.20** per pound U_3O_8, up $0.05 since last month. The calculation includes 14 transactions involving a total of 2.2 million pounds U_3O_8 and equivalent UF_6, and covers a period of 3 months.

Loan Rate
unchanged at 4%

The **Loan Rate** is **4 percent** per annum, unchanged.

Conversion Value
$1.80, unchanged

The **Conversion Value** is **$1.80** per pound U as UF_6, unchanged since last month. Active secondary market supply for conversion services for delivery within three years totals 1.7 million pounds U as UF_6. Active demand totals 565 thousand pounds U as UF_6. No secondary market conversion transactions are reported.

SWU Value for
delivery within
one year: $78

The **SWU Value** at .3 tails and for delivery within one year is **$78** per SWU, up $3 since last month. One secondary market SWU transaction is reported.

* * *

Pricing

This month's Pricing section focuses on the facts, implications and market reactions to the District Court order involving DOE and three US uranium producers. In addition, subsequent articles cover some related topics in depth, including:

1. A review of the status of Judge Carrigan's order, the DOE appeal and request for a stay of the injunction, and other legal procedures in the Tenth District Court and the Tenth Circuit Court of Appeals.
2. An update of the status of the Domenici legislation currently in committee in the US Congress. The legislation would require a 50-percent embargo of non-US uranium for US utilities, as well as a variety of other provisions important to the industry.
3. A review of the report by the US Trade Representative pertaining to possible uranium import restrictions, the Reagan Administration's free-trade stance, and US trade policies in general.

Essay

Efforts to restrict the amount of foreign uranium used in the US nuclear power program are not new. This article traces the history of limitations on the enrichment of non-US uranium and previous attempts to enact legislative methods to bolster the US uranium production sector.

Analysis and
Commentary

The US uranium industry, which produced just over 11 million pounds U_3O_8 in 1985, could increase its production by more than 50 percent if economic conditions encourage expansion.

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AUGUST 1986 NUMBER 216

MONTHLY REPORT

ON THE NUCLEAR FUEL MARKET

NUEXCO

Three Park Central 1515 Arapahoe Street, Suite 1045 Denver, Colorado 80202

HEADQUARTERS

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Vice Chairman of the Board of Partners and Chief Executive Officer
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Directors of Operations
Business and Financial Affairs — James E. Lewis
Administration — J. Fred Lawrence
Legal and Regulatory Affairs — Frederick J. Boyne

NUEXCO FUEL BROKERAGE SERVICES

Manager of Fuel Brokerage
Earl E. Hoellen, Jr.

BROKERAGE SERVICE LOCATIONS

UNITED STATES

DENVER
Three Park Central
1515 Arapahoe Street
Suite 900
Denver, Colorado 80202
Telephone: (303) 893-4015
Telecopy: (303) 825-4821
Telex: 450202 (NUEXCO DVR)

Managing Broker
Earl E. Hoellen, Jr.

MENLO PARK
Bldg. 3, Suite 290
3000 Sand Hill Road
Menlo Park, California 94025
Telephone: (415) 854-1510
Telecopy: (415) 854-2115
Telex: 470674 (NUEXCO UI)

Managing Broker
George White, Jr.

EUROPE

FERNEY-VOLTAIRE
13 chemin du Levant
01210 Ferney-Voltaire
France
Telephone: (33-50) 428035
Telecopy: (33-50) 428526
Telex: 385288 (NUEXCO F)

Managing Broker
James E. Vaughan

ZURICH
135 Zurichstrasse
CH-8700 Kusnacht
Switzerland
Telephone: (41-01) 910-8977
Telecopy: (41-01) 910-6672
Telex: 58877 (COMAG)

Managing Broker
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NUEXCO

MONTHLY REPORT ON THE NUCLEAR FUEL MARKET

August 1986 No. 216

GEORGE WHITE, JR., *EDITOR* CLARK M. BEYER, *ASSOCIATE EDITOR*

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To Our Readers

Nuexco would like to announce the centralization of US brokerage operations at its Denver headquarters. This consolidation of our executive, financial, consulting, market research, and legal personnel in Denver will enhance our ability to offer integrated, expanded services such as financing, arbitration, escrow agency, fuel management, etc., in addition to brokerage services. Effective August 4, Earl Hoellen and Bob Alexander, who have been located in Stamford, Connecticut, will move to Denver, where Earl will direct Nuexco's worldwide brokerage operations. All brokers will work closely with Sam Freeman, Jim Lewis, and Fred Boyne in developing and structuring the increasingly complex arrangements required to achieve solutions to the business and marketing problems present in today's environment. In the near future, Don Radcliffe will relocate from our Menlo Park, California office to Denver, where he will also conduct brokerage activities. George White will continue to handle brokerage activities from the Menlo Park office. Brokers will be available in the Denver office from 7:00 a.m. Mountain Time (9:00 a.m. Eastern Time) beginning August 4.

Further, Jerry Reaves, most recently a consultant dealing primarily with US uranium producers, has left Nuexco to pursue other business interests. We wish Jerry the best of luck in his new activities.

* * *

Nuexco will host a hospitality suite during the Uranium Institute's Eleventh Annual Symposium in London, England. The suite will be located at the Savoy Hotel, September 2-4. Nuexco will also host a hospitality suite during the Atomic Industrial Forum Uranium Seminar, September 14-17, at the Jackson Lake Lodge in Grand Teton National Park, Wyoming. We look forward to seeing you at these events.

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NATURAL URANIUM AND SECONDARY MARKET CONVERSION
(All data as of July 31, 1986)

The **Exchange Value** is **$17.00** per pound U_3O_8, unchanged since last month. **Active supply** of natural uranium (concentrates and UF_6) for spot or near-term delivery totals **3,875,000** pounds U_3O_8 equivalent, down 175 thousand pounds since last month. The corresponding figure for **active demand** is **2,700,000** pounds, up 650 thousand pounds. The spot and near-term **supply-demand ratio** fell to 1.4:1.

The *Current Market Data* section of this Report lists seven natural uranium sales, involving approximately 1.2 million pounds equivalent U_3O_8. All of the transactions involved spot or near-term delivery, and six met the criteria for inclusion in the current Transaction Value calculation. Four of the transactions involved natural UF_6.

The **Transaction Value** is **$17.50** per pound U_3O_8, up $0.30 since last month. The substantial rise in the Transaction Value is due to two factors. First, the removal of April transactions, several of which took place at prices below $17.00, contributed to the rise in the value. Also, some of the transactions reported this month involve US-origin material for delivery in 1987, the prices of which reflect both origin premium and escalation factors. The calculation extends over a 3-month period and includes 13 transactions involving 2.5 million pounds equivalent U_3O_8.

The **UF_6 Value** is **$48.25** per kilogram U in UF_6, unchanged since last month.

The **Conversion Value** is **$1.80** per pound U in UF_6, unchanged since last month. Active supply of secondary market conversion services for delivery within three years totals 1.7 million pounds U as UF_6. Active demand totals 565 thousand pounds U as UF_6. No secondary market conversion transactions are reported.

The **Loan Rate** is **4 percent** per annum, unchanged.

* * *

The Exchange and UF_6 Values were unchanged as of the end of July, as little market activity was observed outside the USA. Several US utilities have made purchases or expressed interest in US-origin uranium in the last six weeks, and the premium sought by sellers of US-origin material appeared to increase during early July. However, late in the month the Tenth Circuit Court granted DOE a stay pending appeal of the injunction requiring it to enrich no more than 25 percent non-US origin feed in the second half of 1986. Thus, the ability of US utilities to deliver non-US feed to DOE for enrichment seems secure at least through September 11, the day tentatively scheduled by the Circuit Court for initial hearings of oral arguments.

The market is currently exhibiting a wide range of prices. The chief reason for this situation is the existence of premiums or discounts, depending upon the origin of the uranium, attached to selling prices. A US buyer's inflexibility or need to fill a near-term DOE enrichment requirement may cause it to pay a substantial premium for US-origin uranium, whether by way of swaps or obtained directly from US producers, whose asking prices generally are well above Exchange Value. Those holding substantial US-origin inventories, or confident that no enrichment limitations ultimately will be placed on DOE may choose to continue to buy Canadian or other origin at prices around the Exchange Value. Outside the USA, Southern African-origin uranium is apparently available at prices well below Exchange Value because the political liability has decreased interest in that material except in special circumstances. Thus, the current uranium market appears more sensitive to origin than it has been at any time in the last several years.

Demand increased this month, but much of it is discretionary, as utilities wait to determine the outcome of judicial and legislative proceedings concerning uranium use. There remains a great deal of uncertainty regarding how and when any limitation or embargo might come into effect. The stay granted to DOE in its lawsuit against three US producers has postponed the implementation of restrictions on the enrichment of foreign-origin uranium for use in US plants, alleviating (at least temporarily) some upward pressure on the premium for US material.

The impact of these recent uncertainties concerning the origin of uranium has become apparent in the longer-term market for uranium. US utilities, for the most part, have deferred entering negotiations for long-term supply because of their unwillingness to contract for non-US origin that may be unusable in the future, either because of possible restrictions on the DOE enrichment of that material or because of an embargo on its use in the USA. Moreover, the increasing scrutiny of long-term supply arrangements by public utility commissions has discouraged many US utilities from entering agreements for long-term US uranium supply at prices which are well above current market levels.

* * *

ENRICHED URANIUM AND SWUS

The **SWU Value** as of July 31, 1986, is $78 per SWU, unchanged since last month. This refers to SWU at a tails assay of 0.30 weight-percent U_{235} and for delivery within one year. No secondary market SWU transactions are reported this month.

The secondary market for SWU remains dormant due to the general absence of buyers with near-term needs. Although some USEC holders in the USA were considering non-DOE enrichment as a short-term solution for enriching their non-US mate-

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rial, the stay pending appeal of the District Court injunction has caused them to postpone or abandon that strategy. Absent those possibilities, the market remains largely inactive.

FURTHER DEVELOPMENTS IN THE US PRODUCER/DOE LAWSUIT

On July 21, the Tenth Circuit Court of Appeals granted DOE's request for a stay of the District Court order entered on June 20, 1986, which required DOE to implement restrictions on the enrichment of foreign-origin uranium for use in US plants until the viability of the US industry is restored. Because the stay was granted, however, Judge J.R. Carrigan's injunction will not go into effect while the appeal in the Tenth Circuit Court is pending.

Carrigan had found that the producers were entitled to relief under section 2201(v) of the Atomic Energy Act. Count I of the lawsuit asserted that DOE had violated that section by not assuring a viable domestic uranium industry. Carrigan then ordered immediate injunctive relief, calling for the provision that 75 percent of the uranium enriched by DOE from June 6, 1986 to December 31, 1986 for use in US reactors must be of US origin; and that as of January 1, 1987, and continuing until the viability of the domestic uranium industry was assured, DOE shall not enrich *any* foreign uranium for use in US reactors.

DOE filed a Notice of Appeal and motion for stay pending appeal (with a memorandum in support of that motion) within several days of the District Court ruling. Observers expected Judge Carrigan to either grant or deny the motion for stay within a few weeks, but as of early July, he had not responded. DOE then took the stay request to the Tenth Circuit Court of Appeals (which has jurisdiction over matters under appeal from the District Court). DOE's application to stay the order was heard by three Circuit Court Judges, who ruled on July 21 that the order is stayed until further order of the Circuit Court.

Furthermore, the Circuit Court ordered that the issues involving Count I should be argued and submitted together with the issues of Count II of the five-count lawsuit, in an expedited hearing on September 11, 1986. Count II pertained to the legality of DOE's Utility Services Enrichment Contract (USEC), which Judge Carrigan ruled to be null and void in September 1985. That issue had been under appeal in the Tenth Circuit Court since then.

DOE's *Memorandum in Support of Motion for Stay Pending Appeal* was reprinted in its entirety on page 10 of Report 215 (July 1986). It argued the rationale behind DOE's motion for stay pending appeal. Among other reasons, DOE stated that

— DOE already had in its possession a high percentage of foreign feedstocks designated for use in US reactors. DOE claimed the order would prevent it from enriching all of the delivered feedstock needed for US reactors. Therefore, domestic utilities and DOE would suffer "irreparable injury without a stay," which "could result in shutdowns of domestic reactors."

—The injunction "impacts adversely on foreign trade, foreign policy, and the nuclear non-proliferation policy of the United States," and is not in the public interest.

The stay pending appeal of the District Court injunction effectively delayed the onset of some potential problems for DOE. At least two US utilities had notified DOE that they intended to deliver non-US origin feed for upcoming enrichment campaigns. If DOE had responded that it could not enrich that material under the terms of the injunction, those utilities may have turned to the secondary market for enrichment or to one of the primary enrichers overseas for that delivery. It is uncertain how many USEC holders would have followed with similar strategies in the next few months if the stay had not been granted, but it is likely that only those with substantial inventories of non-US feed would have responded in that manner.

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CURRENT MARKET DATA

July 31, 1986	Market Values	Active Supply[1] (thousands)	Active Demand[1] (thousands)
EXCHANGE VALUE	**$17.00**/lb. U_3O_8	3,875	2,700
UF_6 VALUE	**$48.25**/kgU		
CONVERSION VALUE	**$1.80**/lb. U as UF_6	1,700	565
SWU VALUE 0.3 tails assay; delivery within one year	**$78**/SWU		
LOAN RATE	**4%**/annum	0	0

	$/lb. U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
TRANSACTION VALUE	**17.50**	2.5	13	3

DEFINITIONS

1. The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.
2. The **UF_6 Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.
3. The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.
4. The **SWU Value** represents Nuexco's judgment of the price at which transactions for the sale of significant quantities of SWUs of stated origin for delivery in the specified time period could be concluded as of the date indicated.
5. The **Loan Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.
6. The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
   a. Transactions closed within the previous three-month period for which delivery is scheduled within one year of the transaction date;
   b. At least ten transactions;
   c. Transactions involving a sum total of at least 2 million pounds U_3O_8 equivalent.

   The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

DERIVATIONS AND COMMENTS

1. All Market Values are based on:
   a. Data from recently completed transactions.
   b. Data from pending transactions.
   c. Firm bids to buy or borrow, and firm offers to sell or lend.
   d. Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell or lend.
2. Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these Market Values.
3. In the determination of the Conversion Value, Nuexco does not consider transportation charges other than those customarily provided by primary suppliers of conversion services.
4. The prices of conversion services or SWUs delivered under long-term contracts with primary suppliers are not considered in the determination of either the Conversion Value or SWU Value.
5. For the SWU Value, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight-percent U_{235} and a product assay of 3.0 weight-percent U_{235}, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
6. In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

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[1] Supply and demand tables in *Current Market Data* section of this Report detail the numbers for each category.

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CURRENT MARKET DATA

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U_3O_8 in Concentrates This Month (Jul 31, 1986)	 Last Month (Jun 30, 1986)	 12 Months Ago (Jul 31, 1985)	per kg. U in Concentrates This Month (Jul 31, 1986)	 Last Month (Jun 30, 1986)	 12 Months Ago (Jul 31, 1985)
Australia (dollar)	27.96	25.35	21.82	72.69	65.92	56.74
Belgium (comm. franc)	742.68	765.08	893.87	1,931	1,989	2,324
Canada (dollar)	23.51	23.60	21.29	61.13	61.36	55.35
Finland (markka)	85.34	87.13	93.14	221.87	226.53	242.14
France (franc)	116.44	119.30	135.43	302.71	310.15	352.08
FRG (mark)	35.89	37.43	44.50	93.30	97.31	115.70
Italy (lira)	25,648	25,703	29,689	64,080	66,822	77,185
Japan (yen)	2,640	2,810	3,739	6,864	7,305	9,721
Netherlands (guilder)	40.46	42.12	49.81	105.18	109.50	129.50
South Africa (rand)	42.43	42.29	32.21	110.30	109.94	83.74
Spain (peseta)	2,310	2,399	2,579	6,007	6,238	6,705
Sweden (krona)	118.96	121.26	130.38	309.28	315.24	338.96
Switzerland (franc)	28.80	30.63	36.33	74.87	79.62	94.46
UK (pound)	11.39	11.10	11.11	29.62	28.86	28.89
US (dollar)	17.00	17.00	15.75	44.20	44.20	40.95

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U_3O_8 in Concentrates This Month (Jul 31, 1986)	 Last Month (Jun 30, 1986)	 12 Months Ago (Jul 31, 1985)	per kg. U in Concentrates This Month (Jul 31, 1986)	 Last Month (Jun 30, 1986)	 12 Months Ago (Jul 31, 1985)
Australia (dollar)	28.78	25.65	20.44	74.83	66.69	53.13
Belgium (comm. franc)	764.53	774.08	837.12	1,988	2,012	2,176
Canada (dollar)	24.20	23.88	19.94	62.93	62.08	51.83
Finland (markka)	87.85	88.16	87.23	228.39	229.20	226.77
France (franc)	119.86	120.70	126.83	311.62	313.80	329.72
FRG (mark)	36.94	37.87	41.68	96.04	98.45	108.35
Italy (lira)	25,373	26,005	27,804	65,965	67,608	72,284
Japan (yen)	2,718	2,843	3,502	7,066	7,391	9,104
Netherlands (guilder)	41.65	42.62	46.65	108.27	110.79	121.27
South Africa (rand)	43.67	42.79	30.16	113.54	111.23	78.42
Spain (peseta)	2,378	2,428	2,415	6,183	6,311	6,279
Sweden (krona)	122.46	122.68	122.10	318.38	318.95	317.44
Switzerland (franc)	29.65	30.99	34.03	77.07	80.56	88.46
UK (pound)	11.73	11.23	10.41	30.49	29.20	27.05
US (dollar)	17.50	17.20	14.75	45.50	44.72	38.35

[1] Calculated using currency exchange rates published in the *Wall Street Journal* on July 31, 1986.

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CURRENT MARKET DATA

CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U as UF_6			per kg. U as UF_6		
Country (currency)	**This Month (Jul 31, 1986)**	**Last Month (Jun 30, 1986)**	**12 Months Ago (Jul 31, 1985)**	**This Month (Jul 31, 1986)**	**Last Month (Jun 30, 1986)**	**12 Months Ago (Jul 31, 1985)**
Australia (dollar)	2.96	2.68	2.22	6.53	5.92	4.89
Belgium (comm. franc)	78.64	81.01	90.81	173.36	178.59	200.19
Canada (dollar)	2.49	2.50	2.16	5.49	5.51	4.77
Finland (markka)	9.04	9.23	9.46	19.92	20.34	20.86
France (franc)	12.33	12.63	13.76	27.18	27.85	30.33
FRG (mark)	3.80	3.96	4.52	8.38	8.74	9.97
Italy (lira)	2,610	2,721	3,016	5,754	6,000	6,649
Japan (yen)	279.55	297.52	379.87	616.29	655.92	837.46
Netherlands (guilder)	4.28	4.46	5.06	9.44	9.83	11.16
South Africa (rand)	4.49	4.48	3.27	9.90	9.87	7.21
Spain (peseta)	244.63	254.06	261.99	539.32	560.10	577.60
Sweden (krona)	12.60	12.84	13.25	27.77	28.30	29.20
Switzerland (franc)	3.05	3.24	3.69	6.72	7.15	8.14
UK (pound)	1.21	1.18	1.13	2.66	2.59	2.49
US (dollar)	1.80	1.80	1.60	3.97	3.97	3.53

SWU VALUE AND UF_6 VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	**SWU Value delivery within one year (Jul 31, 1986)**	**UF_6 Value per kg.U in UF_6 This Month (Jul 31, 1986)**	**UF_6 Value per kg.U in UF_6 Last Month (Jun 30, 1986)**
Australia (dollar)	128.29	79.36	71.96
Belgium (comm. franc)	3,408	2,108	2,171
Canada (dollar)	107.88	66.74	66.99
Finland (markka)	391.57	242.22	247.31
France (franc)	534.25	330.48	338.60
FRG (mark)	164.66	101.86	106.23
Italy (lira)	113,093	69,958	72,951
Japan (yen)	12,114	7,493	7,975
Netherlands (guilder)	185.63	114.83	119.55
South Africa (rand)	194.66	120.41	120.02
Spain (peseta)	10,601	6,557	6,810
Sweden (krona)	545.84	337.65	344.15
Switzerland (franc)	132.14	81.74	86.92
UK (pound)	52.28	32.34	31.51
US (dollar)	78.00	48.25	48.25

[1] Calculated using currency exchange rates published in the *Wall Street Journal* on July 31, 1986.

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CURRENT MARKET DATA

RECENT TRANSACTIONS[1]

Uranium Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price as Percent of Current Exchange or UF_6 Value	Seller	Buyer	Remarks
3779	1987	101-300	108	Trader	Utility	UF_6.
3778	1986	less than 50	102	Producer	Producer	
3777	1987	101-300	109	Producer	Utility	UF_6.
3773	1986	101-300	100-102	R[5]	Utility	
3772	1986	101-300	100-102	R[5]	Utility	
3771	1986	101-300	R[5]	Trader	Utility	UF_6.
3760	1986	less than 50	112	Trader	Utility	UF_6.

[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] If tails assay is unknown or unspecified, Nuexco's calculation of SWU quantity assumes 0.20 w/o tails assay.

[3] Price is not normalized to 0.20% tails assay.

[4] Refers to SWU Value that corresponds to SWUs included in transaction. When prices and SWU values are expressed as discounts (e.g. X dollars less than DOE's USEC base price at time of delivery), the percentage refers to the ratio of the *discounts*, not the ratio of the prices.

[5] The notation *R* means that Nuexco either does not know, or that Nuexco has restricted that information to protect client confidentiality.

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URANIUM SUPPLY
(July 31, 1986)

	Delivery Period[1] (Thousands of Pounds U_3O_8)		
Nuexco Project Number	**Spot or Near-term[2]**	**Intermediate or Long-term**	**Remarks**
Available for Sale:			
ACTIVE			
2335	400	—	
2740	100	—	
2764	260	—	UF_6
2765	260	—	UF_6
2777	500	—	
2889	100	—	
2967	100	—	
2973*	15	—	
2989	40	—	
3010	400	300 per year	
3023	500	500	UF_6
3121	1,200	—	
2263	—	400 per year	1987 on
2625	—	500 per year	1987 on
2781	—	250 per year	1988-95
2927	—	220 per year	1987-90
2981*	—	600 per year	1988-91
TOTAL:	3,875		
INACTIVE			
2297	200	200 per year	1988-89
2336	250	250 per year	1987-94
2389	75	75 per year	1987-90
2703	750	—	
2810	195	175	UF_6
2813	30	—	
2853	65	—	
TOTAL:	1,565		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2826.

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CURRENT MARKET DATA

URANIUM DEMAND
(July 31, 1986)

	Delivery Period[1] (Thousands of Pounds U_3O_8)		
Nuexco Project Number	**Spot or Near-term[2]**	**Intermediate or long-term**	**Remarks**
Inquiries to Purchase: ACTIVE			
2681	500	500 per year	UF_6 or U_3O_8; 1988
2782	600	700	1988
2784*	100	—	
2928	450	—	
2934*	500	—	
2951*	250	100 per year	1987-91
2966*	200	—	
3072*	100	—	
2738	—	1,000	1989-on
2760	—	750 per year	1987-90
TOTAL:	2,700		
INACTIVE			
2661	250	250 per year	1986-87
2733*	500	—	
2798	70	—	
2857	—	300	1988-95
TOTAL:	820		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: None.

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LOAN SUPPLY AND DEMAND
(July 31, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Within 1 Year	Beyond 1 Year	Remarks
Available for Loan:			
INACTIVE			
1938	2,000	—	UF_6
2036	500	—	
2667	800	—	
2920	2,000	—	
TOTAL:	5,300		

*New or revised since last month.

[1] Measured from the date of this Report.

Projects removed since last month: None.

No inquiries to borrow are reported this month.

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CURRENT MARKET DATA

CONVERSION SUPPLY AND DEMAND
(July 31, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U as UF_6) Within 3 Years	 Beyond 3 Years	Remarks
Available for Sale:			
ACTIVE			
2849	550	500	1987-90
2859	750	750	
2988	400	500	
TOTAL:	1,700		
Inquiries to Purchase:			
ACTIVE			
2833	400	—	
2974	165	—	
TOTAL:	565		

*New or revised since last month.

[1] Measured from the date of this Report.

Projects removed since last month: None.

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SWU SUPPLY AND DEMAND
(July 31, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of SWUs) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
2571	—	55	1987
2855	250	—	
2873	40	—	
2953	200	—	
3026*	15	—	
TOTAL:	505		
INACTIVE			
2410A	340	—	
TOTAL:	340		
Inquiries to Purchase:			
INACTIVE			
2879	250	—	
2878*	60	—	
TOTAL:	310		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes SWUs deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2914.

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STATUS OF DOE'S PROPOSED ENRICHMENT CRITERIA

Introduction

The Department of Energy has concluded its "Comment" period and established the final wording for the rulemaking it is conducting regarding proposed revisions to its criteria governing uranium enrichment. On July 24, DOE submitted the revised criteria to Congress, in the form of a proposed amendment to the US Code of Federal Regulations, to begin the mandatory 45-day review period. If Congress fails to pass legislation against the proposed rule during that period, the criteria will replace those currently in effect. This article serves as a follow-up to the article that appeared in Report 211 (March 1986, page 4); some of the details of the proposed criteria mentioned in that article have been subsequently altered. The following analysis examines the important details of the proposed criteria and their potential impact on the enrichment market, especially in light of the recent events in the lawsuit involving US uranium producers and DOE.

Background

The basis for the rulemaking procedure lies in the enactment of the Atomic Energy Act of 1954 and its subsequent amendments. The Private Ownership of Special Nuclear Materials Act, passed by Congress in 1964, permitted private ownership of fissionable materials in the USA. The 1964 Act also amended the 1954 Atomic Energy Act to include Section 161(v), authorizing the Atomic Energy Commission (DOE's predecessor) to "enter into contracts to provide…for the producing or enriching of special nuclear material…" [42 U.S.C. 2201(v)]. Furthermore, the section required the AEC to "establish criteria in writing setting forth the terms and conditions under which (enrichment) services…shall be made available." The Act required that the proposed criteria be submitted to Congress for a period of 45 days prior to the actual implementation of the criteria.

Section 161(v) included other important provisions:

1. "(DOE), to the extent necessary to assure the maintenance of a viable domestic uranium industry, shall not offer such (enrichment) services for source or special nuclear materials of foreign origin intended for use in a utilization facility within or under the jurisdiction of the United States."
2. "That prices for services…shall be established on a nondiscriminatory basis;"
3. "…any prices established under this subsection shall be on a basis of recovery of the Government's cost over a reasonable period of time." (As originally adopted, this provision stated that prices for enrichment services would be established on a basis of which would allow "reasonable compensation for the Government." After considerable Congressional debate over the plausibility of that language and the desire for a more effective means to recover the government's costs, the current version was adopted by Congress in 1970 as an amendment to the Atomic Energy Act.) The actual intentions of Congress when formulating the original language, along with subsequent committee reports and the 1970 amendment, have become important considerations in connection with the current dispute over the size of DOE's enrichment debt.

The Establishment of Criteria

Following the Congressional mandate in 1964 to establish criteria governing enrichment, the AEC formulated the Uranium Enrichment Services Criteria in December 1966, setting forth the terms and conditions for the sale of enrichment services. The criteria provided for different types of contracts (fixed-commitment, requirements-type, or a combination thereof), a total limitation on the enrichment of foreign uranium for use in US plants, delivery schedules, charges for services, and other specifications. Frequent revisions to these criteria followed:

1. The aforementioned 1970 Amendment to the Atomic Energy Act resulted in the AEC adoption, in March 1971, of criteria consistent with that amendment. The fundamental change to the criteria was in the language regarding the recovery of the government's costs.
2. In August 1973, the AEC again revised the criteria in order to prescribe the fixed-commitment contract (LTFC) as the primary form of DOE enrichment contract. This was done to assure the availability of enrichment capacity in later decades. In addition, this revision eliminated the requirement for a ceiling price for enrichment services.
3. In October 1974, the criteria were revised to phase out over a period of several years the restrictions on the enrichment of foreign-origin uranium for use in US reactors, an event that DOE believes to be relevant to the US producer-DOE litigation.
4. Minor changes to the criteria were implemented in revisions of June 1978 and May 1979. The current criteria have been in effect since 1979.

Impetus for Proposed Criteria Revisions

As a result of a major marketing initiative in early 1984, DOE began implementing a series of steps designed to bolster its declining worldwide enrichment market share. The first of these moves under the new "businesslike" strategy that DOE heralded during 1984 was the issuance of the Utility Services enrichment contract (USEC). The response to the new, requirements-based contract was very favorable. Contract negotiations took place throughout the summer of 1984, and, by the time all of the conversions to the USEC were completed, DOE had modified

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the conversion terms to provide concessions to each class of customer. As a result, the number of contract conversions exceeded even DOE's expectations.

However, many groups found fault with the DOE strategy in general and the USEC in particular. In December 1984, the General Accounting Office (GAO) released the results of its investigation into DOE's actions surrounding the issuance of the USEC. Among other points, the GAO study found that the guaranteed ceiling price of the USEC either conflicts with or is not specifically authorized in the present enrichment criteria. Moreover, the write-off of certain costs of the gaseous diffusion plants that DOE used in calculating the USEC SWU price may have been unlawful and inappropriate.

Also in December 1984, three US uranium producers filed a five-count lawsuit against DOE. Count II asserted that the new contract was invalid because its terms amounted to a change in the criteria governing enrichment, and, because the contract was not submitted to Congress for its mandatory review, it was not a valid contract. The following September, the US District Court in Colorado agreed with the producers. Judge J.R. Carrigan stated that the critical issue regarding the USEC was that it "...[amounted] to new criteria governing enrichment." He cited three examples:

1. Existing criteria require that the primary DOE enrichment contract must be of a Fixed-Commitment type, which the USEC clearly is not.

2. The USEC sets a ceiling price for enrichment services, which conceivably could prevent the government from recovering its costs. For the same reasons, the provision in the original criteria which guaranteed a ceiling price was eliminated by the aforementioned 1973 revision.

3. Provisions in the USEC that base termination penalties on the period of notice that the customer gives DOE, rather than on estimates of costs that will be incurred as a result of customer terminations, should be considered new criteria.

Faced with these and other criticisms, DOE began to formulate new criteria in an attempt to alleviate as many of these problems as possible in a single rulemaking procedure. Meanwhile, during 1985 it continued to announce broad moves designed to increase customer confidence in its new strategy. In short, these included two separate incentive-priced SWU campaigns in an attempt to secure as much of its customers' remaining requirements as possible; and DOE's announcements of concrete measures pertaining to its present and future performance and pricing schemes, including USEC base price reductions, a commitment to AVLIS deployment, and the cancellation of the gas centrifuge enrichment plant (GCEP) program.

The Proposed Criteria — January 1986

DOE's latest criteria revisions first appeared in a Notice of Proposed Rulemaking in the *Federal Register* (Vol. 51, No. 19) on January 29, 1986. The actual criteria consisted of fifteen subsections (762.1-762.15) covering many aspects of contracts, feed specifications, prices, costs, and other pertinent issues. Several pages of supplementary information, mostly consisting of DOE's rationale for the revisions and reasoning behind the exact language, preceded the proposed wording of the criteria. DOE requested written comments on the proposal by February 28, 1986, and held a public hearing on the matter in March. (See article on page 4 of Report 211 [March 1986] discussing several of the important points in that version of the proposed criteria.)

Once again, the GAO criticized DOE's strategy. In a legal opinion issued on February 19, the GAO stated, "... whatever the policy merits of (Department of) Energy's proposal, it cannot legally be accomplished through rulemaking." The GAO specifically took issue with three aspects of the proposed criteria:

— The modification that allows DOE flexibility in pricing and other contract terms without congressional oversight (Section 762.4);

— the changes that permit individually negotiated contracts rather than standard contracts (Sections 762.4 and 762.14), and;

— the "Nondiscrimination" criteria (Section 762.7).

In addition, the opinion expressed doubt that DOE had correctly and sufficiently addressed the problem of the viability of the US uranium industry in the proposed criteria. Section 762.3 — *Enrichment of Uranium of Foreign Origin* merely stated, "A domestic customer shall certify the country of origin of feed material delivered to DOE." Finally, the GAO stated that the changes in criteria conflict with established law and must be implemented through legislative action rather than a rulemaking procedure.

DOE issued a Notice of Additional Information which appeared in the *Federal Register* on April 25, 1986, providing for an additional written comment period of 30 days. DOE stated that it was responding to "requests for further analysis with respect to those provisions of the proposed uranium enrichment criteria which relate to (1) the 'enrichment of foreign origin uranium' and (2) the 'recovery of prior government costs.'" However, DOE noted that it had clearly discussed its position regarding enrichment of foreign-origin uranium in the preamble to the proposed criteria, adding that "interested persons have a more than sufficient basis on which to comment." Therefore, DOE would attempt to clarify only the cost recovery issue in the April Notice.

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Issuance of the Proposed Criteria — July 1986

On July 24, DOE's final wording of the criteria had been established and was submitted to Congress. It appeared in the *Federal Register* on July 29, 1986. (This version of the proposed criteria is reprinted on page 15 of this Report.) Prior to 1977, the Joint Committee on Atomic Energy (which consisted of members of both the House of Representatives and the Senate) provided oversight of AEC activities, including the review of uranium enrichment criteria. That committee was abolished in 1977, and although its functions have been assigned to other House and Senate subcommittees, no particular committees were specified. As of press time, it appears that the Senate Committee on Energy and Natural Resources (of which Senator Domenici is a member) and the House Comittee on Interior and Insular Affairs will be among the committees reviewing the proposed criteria. In addition, other Senate Committees — on Environment and Public Works, and Appropriations; and House Committees — on Energy and Commerce, Science and Technology, and Appropriations — may also ask to review the proposal.

In general, the proposed criteria submitted to Congress in July are not substantially different than the language issued for review and comment in January 1986. DOE stated that it had "considered all the comments carefully in its deliberations concerning the revised criteria and has modified the proposed criteria where appropriate." These modifications included the following.

1. *General* (§ 762.1) — Two additions to this section required that enrichment contracts must specify the customer's commitment to DOE to take services and the charge for cancellation of that commitment, and that contracts must be long term in nature, unless a short-term contract would "promote the objectives of the [Atomic Energy Act]."

2. *Enrichment of Uranium of Foreign Origin* (§ 762.3) — DOE removed the sentence requiring US customers to certify the country of origin of the feed material, replacing it with, "DOE may not restrict the enrichment of uranium of foreign origin for domestic use except to the extent it determines such a restriction is necessary to assure the maintenance of a viable domestic uranium industry." This new wording carefully ties the issue of industry viability with foreign uranium enrichment restrictions, giving DOE the perogative to decide whether restrictions will actually help the US industry. If DOE determines that restricting the enrichment of foreign uranium will not sufficiently revive the US production industry, it is not compelled to act. Indeed, DOE has already argued (with support from the US Trade Representative, among others) that enrichment restrictions will not necessarily assure the viability of the US industry. Predictably, the revision is consistent with the legal argument made by DOE with respect to Count I in the producers' lawsuit against DOE (see Report 215 [July 1986], page 3).

In an extensive argument in the *Supplementary Information* to the proposed criteria submitted to Congress, DOE notes the existence of the US District Court Injunction preventing it from enriching foreign-origin uranium for US use. (The injunction is currently stayed pending appeal.) However, DOE states that it "believes that the [District Court] judgment is erroneous." DOE adds, "In adopting section 762.3, DOE is mindful of the ongoing nature of the . . . litigation. Section 762.3 is being adopted at this time, notwithstanding the . . . litigation, in order to formally record DOE's interpretation of Section 161(v) (of the Atomic Energy Act), (and) to state DOE's determination that restrictions on enrichment of foreign-origin uranium continue to be inappropriate. . ."

3. *Recovery of prior unrecouped Government costs* (§ 762.6) — This section, which requires DOE to allocate a portion of enrichment revenues for the repayment of prior government costs, is closely related to Section 762.5 ("Costs"), which deals with DOE's cost recovery. Many comments DOE received on this section pertained to the various disagreements over the size of the enrichment debt to be recovered. Also, several members of the Senate Committee on Energy and Natural Resources objected to this section during the initial comment period because they believed it was inconsistent with federal deficit reduction measures (specifically, the Consolidated Omnibus Budget Reconciliation Act of 1985 [COBRA]). In response, DOE added the qualification, "DOE shall determine the amount to be returned to the US Treasury each year," and included several factors that are supposed to influence that determination. This addition would allow DOE considerable flexibility in determining repayments to the Treasury.

Potential Impact

Despite the fact that during the comment period DOE received comments on virtually every section in the proposed criteria, two issues stand out as the most controversial. Both of these issues are the subject of extensive Congressional interest, and either of them could prevent Congressional acceptance of the proposed criteria.

Most important is the cost recovery issue (§ 762.5), which has already prompted a vast range of criticism. While DOE values the enrichment debt at $3.4 billion, the GAO and the National Taxpayers Union (a lobbying group) assert that the actual figure is as high as $7 billion. Meanwhile, many US utilities and other parties believe that the actual debt is far lower than $3.4 billion. (Senator Domenici's legislation, if passed in its current form, ignores the actual amount of the enrichment debt, writing it down to only *$350 million* as of FY86.) This issue is

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one of the chief obstacles that may prevent DOE from securing Congressional approval for the proposed criteria.

The second major obstacle is DOE's stance regarding enrichment limitations on foreign-origin uranium for use in US plants. Senator Domenici's strong support of the domestic uranium industry and his influential political reputation may persuade many of his Congressional colleagues that DOE should take a more active role in assuring the existence of a thriving domestic industry, a position that DOE is clearly avoiding in its proposed criteria. Conversely, a large segment of Congress can be expected to align with the Reagan Administration's free-trade philosophy, disavowing any usage or enrichment limitations on foreign-origin uranium.

While before the various Congressional committees, DOE will likely be urged to make additional modifications, but it is doubtful that DOE will accede to such requests. If Congress cannot persuade DOE, it appears that Congress must pass legislation or at least adopt a joint resolution within the 45-day review period in order to prevent the proposed critiera from taking effect.

Relationship to the District Court Rulings

A US District Court ruling interpreting a federal statute will take precedence over an administrative rulemaking. Thus, if upheld in the Tenth Circuit Court of Appeals, Judge Carrigan's order requiring limitations on the enrichment of foreign-origin uranium for use in US reactors will take effect (absent further stays or appeals) regardless of any DOE rulemaking on that issue, or the presence of criteria which specifically prohibit limitations. Moreover, as part of his ruling, Carrigan ordered DOE to commence a rulemaking procedure to establish criteria consistent with his order. In essence, DOE ignored that order and proceeded with a rulemaking that was consistent with *its interpretation* of the relevant portions of the Atomic Energy Act that deal with assuring the viability of the domestic uranium industry. Whether DOE will be allowed the discretion to determine the point at which foreign-origin enrichment limitations are necessary depends not only on the Congressional acceptance of the proposed critiera, but also on DOE's success in the Tenth Circuit Court of Appeals. The hearing before the Tenth Circuit on Carrigan's ruling, both regarding enrichment limitations and the validity of the USEC, is scheduled to begin September 11, 1986.

The validity of the last section (§ 762.15) of the proposed criteria may also depend on the outcome of the producer/DOE litigation before the Tenth Circuit. Judge Carrigan ruled (as to Count II of the lawsuit) that certain terms contained in the USEC amounted to a change in the criteria governing enrichment, and, because there had been no Congressional review, the contract was null and void. "Prior Contracts" (§ 762.15) states that "All contracts under which DOE was providing enrichment services prior to the adoption of these criteria are valid. These prior contracts may be amended to conform to these criteria without penalty, if both parties agree." DOE received comments to the effect that this section was an improper attempt to retroactively validate the USEC following Carrigan's null and void ruling. However, DOE maintains that "a change in criteria should not invalidate existing contracts," and that the contracts were negotiated "in good faith between DOE and its customers." Again, DOE must prevail in the appeal process in order to successfully implement this section of the criteria.

NOTE: As of August 5, the US Senate had passed a joint resolution prohibiting DOE from submitting the proposed criteria. If the resolution is passed in the House of Representatives and signed by President Reagan, the proposed criteria will not take effect. It is likely that the joint resolution will be attached to a bill that Reagan is expected to sign without hesitation, such as the debt-reduction bill.

PART 762 - URANIUM ENRICHMENT SERVICES CRITERIA

Section

762. 1 General
762. 2 Definitions
762. 3 Enrichment of Uranium of Foreign Origin
762. 4 Prices
762. 5 Costs
762. 6 Recovery of Prior Unrecouped Government Costs
762. 7 Non-discrimination
762. 8 Amendment of Contract
762. 9 Termination by DOE
762.10 Termination by Customer
762.11 Quantities and Form of Feed and Product Material
762.12 Customer's Option to Acquire Tails Material
762.13 Responsibility for Material Meeting Specifications
762.14 Other Terms
762.15 Prior Contracts

Authority: Section 161(v) of the Atomic Energy Act of 1954, 68 Stat. 921 (42 U.S.C.§2201(v)).

§762.1 General.

(a) Authority. These criteria set forth the general terms and conditions applicable to the provision to civilian customers of uranium enrichment services in facilities owned by DOE, as authorized by the Atomic Energy Act of 1954, as amended (the Act). Specifically, these

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criteria are established pursuant to Section 161(v) of the Act, which was added by Public Law 88-489, the "Private Ownership of Special Nuclear Materials Act."

(b) Eligible customers. DOE may enter into contracts for providing enrichment services with licensees and cooperative agreement customers. Enrichment services can be offered to cooperative agreement customers only while comparable services are available to licensees and cannot be offered for prices less than the prices for services to licensees.

(c) Capacity limitations. DOE will not enter into contracts in excess of the available capabilities of DOE. Available capability consists of inventories of material available or committed to DOE and the physical capability of existing and authorized enrichment plants, fully powered and operated without limitation as to mode of operation, but as reduced by potential commitments involving forecasts of Government needs.

(d) Sale limitations. Except as specifically provided, nothing in this notice shall be deemed to affect the sale or leasing of special nuclear material by DOE or the entering into "barter" arrangements whereby special nuclear material is distributed pursuant to Section 54 of the Act and source material is accepted in part payment therefor.

(e) Committed services. Contracts for the provision of enrichment services shall specify the extent to which a customer is committed to take services from DOE and the charge, if any, for not taking committed services.

(f) Duration. Contracts for the provision of enrichment services shall be long-term, except that DOE may offer short-term contracts if, in its view, such contracts would promote the objectives of the AEA.

(g) Revision of criteria. The criteria contained in this notice are subject to change by DOE from time to time; however, any such changes shall be developed in conference with applicable administrative guidelines and shall be submitted to the Committees of the Senate and House of Representatives which under the rules of the Senate and House have jurisdiction for review in accordance with the Act.

§762.2 Definitions.

(a) "Enrichment services" means the separative work necessary to enrich or further enrich uranium in the isotope U-235.

(b) "Cooperative agreement customer" means a person receiving enrichment services pursuant to an agreement for cooperation arranged pursuant to section 123 of the AEA.

(c) "Licensee" means a person licensed under sections 53, 63, 103 or 104 of the AEA.

(d) "Separative work" means the measure of the effort required to separate a quantity of uranium feed material into (1) an enriched fraction containing a higher concentration of U-235 than the feed material and (2) a tails fraction containing a lower concentration of U-235.

§762.3 Enrichment of uranium of foreign origin.

DOE may not restrict the enrichment of uranium of foreign origin for domestic use except to the extent it determines such a restriction is necessary to assure the maintenance of a viable domestic uranium industry.

§762.4 Prices.

DOE may negotiate prices in individual enrichment services contracts in accordance with an overall approach intended to maintain the long-term competitive position of DOE while obtaining the recovery of the Government's costs over a reasonable period of time.

§762.5 Costs.

DOE will establish charges for enrichment services on a basis that recovers appropriate Government costs over a reasonable period of time. Such costs will be determined on a basis that includes the costs incurred in providing enrichment services as follows:

(a) electric power and all other costs, direct and indirect, of operating the enrichment plants;
(b) depreciation of enrichment plants;
(c) costs of process development;
(d) cost of DOE administration and other Government functions in support of the Enrichment Program; and
(e) imputed interest on investment in plant, working capital, the natural uranium contained in those inventories at the DOE enrichment plants needed to provide enrichment services, and the separative work costs of preproduced inventories.

§762.6 Recovery of Prior Unrecouped Government Costs.

In establishing prices for providing enrichment services for civilian customers, DOE will establish reserves sufficient to return to the Treasury of the United States, over a reasonable period of time, previously unrecouped and unrecovered costs associated with provision of enrichment services to civilian customers. The estimate of such costs will include costs attributable to plant capacity used to provide enrichment services for civilian customers, but will not necessarily include costs attributable to plant capacity or other investments not properly allocable to the Government's costs associated with providing enrichment services to civilian customers. DOE shall determine the amount to be returned to the U.S. Treasury each year. In determining this amount, DOE shall consider all relevant factors, including the following:

(a) long-term financial integrity of the enrichment program;
(b) reliability of service at competitive prices;
(c) market share;
(d) impact upon existing enrichment facilities and other program expenditures;
(e) impact upon research and development; and
(f) need to reduce the deficit.

§762.7 Non-discrimination.

The same prices, as well as other terms and conditions, shall be available to all similarly-situated customers on a non-discriminatory basis, reflecting DOE's judgment of cost differentials associated with supplying enrichment services to different customers.

§762.8 Amendment of contract.

At the request of either DOE or the customer, the parties will negotiate and, to the extent mutually agreed, amend the contract without additional consideration. A contract may provide for renegotiation of prices, as well as other terms and conditions, at specified times or upon request by either party.

§762.9 Termination by DOE.

(a) The contract may be terminated by DOE without cost to DOE upon reasonable notice at such time as commercial enrichment services are provided by another domestic source: Provided, however, that DOE will upon request by the customer rescind any notice of termination and will continue to furnish the services specified in the contract if the services of the domestic source are not available to the customer; (1) to the extent provided for in the DOE contract during the remainder of its terms; and (2) on terms and conditions, including charges, which are considered by the DOE to be reasonable and nondiscriminatory.

(b) DOE may terminate the contract without cost to DOE in the event the customer loses its right to possess enriched uranium, or defaults on its contractual obligations, or becomes involved in bankruptcy proceedings where such involvement interferes with the customer's ability to perform its obligations. In such instances, the customer will be required to pay a termination charge determined as if the customer had terminated the contract.

§762.10 Termination by customer.

The contract shall provide the circumstances under which the customer may terminate the contract in whole or in part. Reasonable and appropriate charges for termination as are negotiated shall be specified in the contract.

§762.11 Quantities and form of feed and product material.

The form of feed and product material shall be UF-6, except where DOE and the customer agree to another form. The quantity of material to be furnished by the customer in relationship to the quantity of enriched uranium to be delivered by DOE and the related amount of separative work to be performed by DOE normally will be determined in accordance with the then current standard table of enrichment services published by DOE. DOE may agree to perform such services in accordance with such other table as is within its capability. DOE will not necessarily use the specific feed material or quantity of material furnished by the customer in producing the enriched uranium delivered to the customer.

§762.12 Customer's option to acquire tails material.

The customer shall be granted an option to acquire tails material (depleted uranium) resulting from the performance of enrichment services. The option as to quantity (kg U) of tails material desired by the customer, within the maximum quantity subject to the option, must be exercised at the time of delivery of the related quantity of feed material. The U-235 assay of the tails material delivered to the customer will be within the sole discretion of DOE. The maximum quantity of depleted uranium subject to the option will be equal to the difference between the total uranium supplied by the customer as feed material and the total enriched uranium furnished to the customer, less processing losses as established from time to time by DOE. Delivery of tails material will normally be at the same time as delivery of enriched uranium.

§762.13 Responsibility for material meeting specifications.

The customer warrants that all feed material meets specifications and, with stated exceptions, agrees to hold DOE and its representatives harmless from all damages, liabilities, or costs arising out of a breach of the warranty where such damages, liabilities, or costs are incurred prior to final acceptance of the feed material by DOE. However the customer is not deprived of any rights under indemnification agreements entered into pursuant to section 170 of the Act (Price-Anderson indemnification). DOE's obligation to furnish specification material to the customer terminates upon final acceptance of such material by the customer.

§762.14 Other terms.

A contract may contain terms and conditions not specified in these criteria, so long as the terms and conditions are not inconsistent with these criteria.

§762.15 Prior contracts.

All contracts under which DOE was providing enrichment services prior to the adoption of these criteria are valid. These prior contracts may be amended to conform to these criteria without penalty, if both parties agree.

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NUCLEAR POWER PROJECTS AFTER CHERNOBYL IN THE FEDERAL REPUBLIC OF GERMANY

Introduction

Given the public opinion sensitivity of nuclear energy policies in many Western nations, the April 26, 1986 accident at the USSR's Chernobyl station is certain to hinder nuclear power development in the West. While the Soviet government insists that Chernobyl will not in any way alter Soviet nuclear power plans, the accident was followed in Europe by the deferral of planned reactors in the Netherlands and Finland and by an Austrian government announcement that the Zwentendorf plant definitely will not be allowed to operate.

However, the Western country likely to experience the most widespread difficulty in its nuclear industry is the Federal Republic of Germany (FRG), where construction and licensing of several projects was underway when the Soviet accident occurred. After years of gradually increasing acceptance under a moderately conservative federal government, nuclear energy has resurfaced as one of the more prominent issues in German politics.

Among the principal world users of nuclear energy, the FRG is comparatively vulnerable to the political effects of Chernobyl for a variety of reasons. In the USA, the effects of the accident have been limited, partly because it occurred in the USSR, but mostly because the US industry had already undergone a series of strict new regulations following the Three Mile Island accident. New pressure for industry changes is likely to focus on evacuation plans. In both France and Japan, a strong political consensus has long supported nuclear energy as a national economic imperative; that consensus is unlikely to be damaged seriously by events in other nations. The German nuclear industry, by contrast, has been troubled by widespread political opposition for many years, and despite that opposition the industry has continued to pursue projects that are prone to attack at each stage of the licensing process.

Vulnerable Projects

Currently, three light water reactors (LWRs) — Isar Unit 2, Emsland and GKN Unit 2 — are under construction in the FRG. Two other LWRs, Brokdorf and Muelheim-Kaerlich, are complete and in the midst of pre-commercial licensing (Table 1). The THTR 300, a prototype high-temperature reactor, received a license early this year to operate for 1,100 days at full power. The Kalkar Fast Breeder Reactor (FBR) in North-Rhine Westfalia, owned by German, Dutch, Belgian and British interests, is complete but delayed pending issuance of a fuel-loading license. Other facilities not yet installed or licensed include a proposed reprocessing plant at Wackersdorf in Bavaria, now in the groundbreaking stage; plans for the expansion of the Nukem and Alkem fuel fabrication facilities in Hessen; and an LWR planned at the Borken site in Hessen, for which permit applications were filed in 1985. All of these projects can be blocked legally through the denial of licenses by politically appointed ministers. Furthermore, some of the country's older units, such as Obrigheim, Wuergassen, Stade and Biblis A, may be vulnerable to political action if it can be demonstrated that the plants do not meet modern safety standards.

Thus far, the LWRs undergoing construction and licensing have been relatively unaffected by the recent surge of anti-nuclear sentiment, with the exception of Brokdorf. Located near the mouth of the Elbe River in Schleswig-Holstein, the new Kraftwerk Union plant has been a target of German intervenors since the late 1970s, when it was the site of violent mass demonstrations. Shortly after the Soviet accident, new demonstrations were organized, and the state government responded by announcing it would withhold a license to load fuel pending the outcome of an inquiry into plant safety. The state government is controlled by the Christian Democrat Party (CDU), which is supportive of the project, so a license may be granted as soon as the authorities detect a more receptive public mood. Nevertheless, to avoid confrontation, the delay could be extended through federal elections in January 1987, after which time the unit's future could be decided by the policies of a new federal government.

THTR Episode

The THTR in North-Rhine Westfalia experienced licensing delays for two years after fuel was initially loaded in August 1983, principally because it is the first commercial-sized unit of its type in Germany and its fuel system uses highly enriched uranium. The owner (Hochtemperatur-Kernkraftwerk GmbH, [HKG]) obtained a full-power license in early 1986 and the unit was undergoing power ascension when the Chernobyl accident occurred. On May 3, following rain showers in Germany, the level of radioactivity in the region of the THTR rose to 50,000 Becquerels per square meter (Bq/m^2). On May 4, a technician loading absorber spheres into the THTR fuel bed used helium-gas pressure from within the core to dislodge spheres that had jammed in the loading tube (Figure 1). As a result, a small amount of graphite dust and helium was discharged through an unfiltered sector of the unit's chimney. While no increase in radioactivity was detected in the region, HKG calculated that for a short time the level of radioactivity had increased by 0.1 Bq/m^2. The owner reported the incident to the state government, where the responsible under-minister confirmed that the discharge was insignificant.

News of the THTR discharge leaked to the public, and in late May the OKO Institute in southern Germany alleged that 60

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percent of the radioactivity in the region around the plant was due to the THTR itself rather than to the Chernobyl accident. The resulting public reaction brought the issue to the attention of the Minister of Economics for North-Rhine Westfalia, Reimut Jochimsen. Mr. Jochimsen claimed he had not been informed of the discharge, and on June 1, without consulting HKG, he ordered that the reactor remain shut down following a two-day outage, pending an investigation of the discharge incident. HKG immediately informed the minister that it had cleared the discharge with the minister's office, but the unit was not allowed to restart until July 20. HKG was ordered to take a number of precautions against any further discharges.

Table 1

NUCLEAR POWER UNITS IN THE FEDERAL REPUBLIC OF GERMANY

Lead Utility and Fuel Buyer	Unit	MWe	Type	COD	Percent Complete
BW/EVS	Philippsburg 1	864	BWR	1980	100
	Philippsburg 2	1268	PWR	1985	100
BAG	Grafenrheinfeld	1235	PWR	1982	100
	Isar 1	870	BWR	1979	100
	Isar 2*	1285	PWR	1988	70
GKN	GKN 1	795	PWR	1976	100
	GKN 2*	1230	PWR	1989	45
HEW	Brunsbuettel	771	BWR	1977	100
	Kruemmel	1260	BWR	1984	100
KWO	Obrigheim 1	328	PWR	1969	100
PE	Wuergassen	640	BWR	1972	100
	Stade	630	PWR	1972	100
	Unterweser	1230	PWR	1979	100
	Grohnde	1290	PWR	1985	100
	Brokdorf*	1290	PWR	1986	100
RWE	Biblis A	1146	PWR	1975	100
	Biblis B	1240	PWR	1977	100
	Gundremmingen B	1244	BWR	1984	100
	Gundremmingen C	1244	BWR	1985	100
	Mülheim-Kaerlich*	1227	PWR	1986	100
SBK	Kalkar*	295	LMFBR	1987	95
VEW	THTR 300	296	HTR	1986	100
	Emsland*	1242	PWR	1988	60
Total		22,920			

*Unit under construction or licensing

BW = Badenwerk AG
BAG = Bayernwerk AG
EVS = Energieversorgung Schwaben AG
GKN = Gemeinschaftskernkraftwerk Neckar GmbH
HEW = Hamburgische Elektricitaetswerke AG
KWO = Kernkraftwerk Obrigheim GmbH
PE = Preussenelektra AG
RWE = Rheinisch-Westfaelisches Elektrizitaetswerk AG
SBK = Schnell-Breuter Kernkraftwerksgesellschaft mbH
VEW = Vereinigte Elektrizitaeswerke Westfalen AG

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The Plutonium Issue

The Kalkar FBR is located west of the THTR in North-Rhine Westfalia and has been subjected to more obstacles from the state's governing Social Democrat Party (SPD). In the case of Kalkar, Mr. Jochimsen has stated unequivocably since the Soviet accident that he will deny any further licenses leading to operation of the finished plant. Technically, the minister's intransigence may be overcome by the intervention of the federal government in Bonn, as the law governing licensing of nuclear facilities allows the federal government authority to direct a state government to grant a license. There is no precedent for such action, however, and there is sufficient ambiguity in the regulations that a state could delay such an order by conducting inquiries into technical aspects of a project. Moreover, such a decision by the federal government to order a state to act in support of a nuclear facility could have damaging political implications for the ruling coalition. The Kalkar situation is unlikely to change at least until federal elections are held in January 1987.

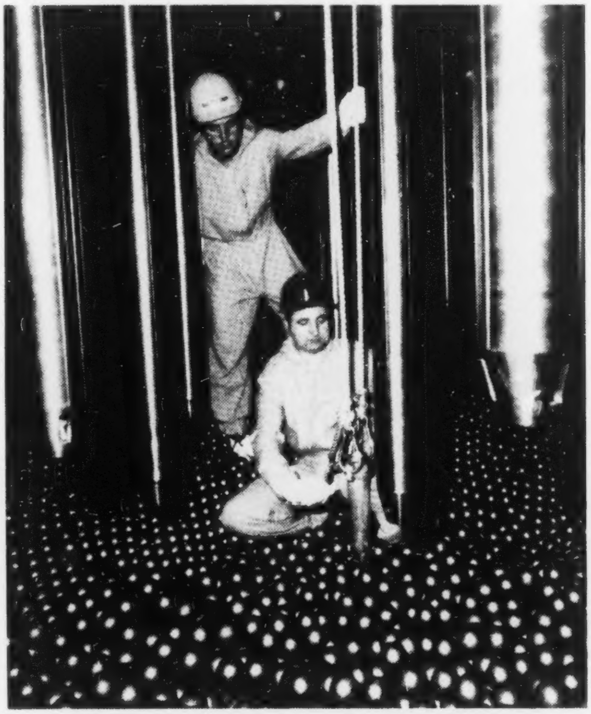

Figure 1. Reactor core of THTR during initial loading (1983), showing fuel spheres and control rods.

The position of the SPD (the main opposition party in German politics) regarding Kalkar reflects an anti-plutonium policy that has become more strictly defined since Chernobyl. The Soviet accident challenged all parties to clarify their positions toward nuclear energy. The SPD responded with ambiguous words about the desirability of phasing out nuclear power altogether, and strong words calling for the rejection of a plutonium economy, including the FBR and domestic reprocessing. Thus, in addition to Kalkar, two companies in the German nuclear fuel cycle have been threatened by the SPD — Alkem, the fabricator of FBR fuel assemblies, and DWK (Deutsche Gesellschaft fuer Wiederaufarbeitung von Kernbrennstoffen mbH), the national reprocessing and spent fuel disposal company.

DWK received a license from the state of Bavaria in 1985 to begin construction of the Wackersdorf reprocessing plant, and groundwork has proceeded since last autumn, amid widespread action by intervenors. Recently, a massive concrete wall was built around the plant site to discourage further obstruction. The state government of Bavaria, known as the most conservative government in the FRG, has not yet wavered in its support of the project. Conversely, in Hessen, the state of the Alkem facility, the SPD governs in coalition with the vehemently anti-nuclear Green party. As part of the coalition arrangement, a member of the Green party holds the office of Minister of Environment in the state government, and has some control over the licensing of nuclear facilities. Any future applications to expand fuel cycle facilities in Hessen, such as Alkem's request to store plutonium commercially on site, are certain to be rejected by the current government.

Threat of SPD/Green Coalition

The principal fear of the German nuclear industry is that the anti-nuclear government coalition existing in Hessen will spread to other states or, at worst, to the federal government. The likelihood of such a development depends on German voters' willingness to accept a "Red-Green" coalition, and on the ability of the SPD and Green parties to establish a working alliance. In elections on June 15 in Lower Saxony, the SPD and Greens together failed to gain a majority in the state legislature by the margin of only one seat, indicating the worst results in 19 years for the conservative parties (CDU and the Free Democrat Party [FDP]) in Lower Saxony. Many voters distrust the Green Party's ecological extremism, and that sentiment undoubtedly contributed to the narrow victory of the conservatives. The SPD itself has repeatedly distanced itself from the Greens; however, it has also demonstrated that it will compromise with them in order to hold power. Internally, the Greens are divided over the integrity of an alliance with the SPD, and the party is closely watching the power-sharing arrangement in Hessen to determine

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if there is any real advantage to such a compromise.

One of the most important tests of the tenability of the SPD/Green coalition will be the state government's action against the nuclear power industry. The Green Party Minister, Mr. Fischer, recently called for the shutdown of RWE's Biblis station, siting a report his staff researched that the power from Biblis is not needed. (The two-unit Biblis plant is the only operating nuclear power station in Hessen; the Kahl reactor was shut down for decommissioning in 1985.) The Green Party has threatened to abandon the coalition government if the SPD does not take measures to implement Mr. Fischer's plan prior to the end of 1986. Thus, the SPD will be forced to arrange a settlement satisfactory to the Greens or risk the formation of a new government in Hessen. The SPD's maneuvering will be particularly significant because its timing may influence the outcome of the federal elections. Currently the SPD holds the most seats of any single party in the German federal parliament, but a coalition of the CDU, CSU (Christian Social Union) and FDP has a controlling majority of some 30 seats.

Conclusion

The electoral power of the anti-nuclear sentiment raised by Chernobyl will not actually be tested until the next federal elections in January 1987, and until then several projects either planned or in development by the German nuclear industry will probably not advance. By then, the major political parties will have further articulated their policies and tested the strength of possible coalitions. At present it seems clear that the SPD will adopt an anti-nuclear platform, including at the least the abandonment of Kalkar and Wackersdorf, and possibly including other cuts to appeal to the ecological Left, such as the retirement of one or more old reactors and a call for the gradual phase-out of nuclear power. There will almost certainly be pressure within the governing coalition, particularly from the CDU, to take concrete steps to moderate the current pro-nuclear policies. Finally, it is entirely possible that the government will withdraw support for one or more controversial projects in a simple effort to retain power.

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1986 US NUCLEAR PLANT LICENSING PROGRESS

During the first half of 1986, five nuclear units in the USA began commercial operation. The number of operating reactors (including those in the final licensing process) has reached 99, and total installed generating capacity in the USA is approximately 90,000 MWe. Table 2 lists the units that have entered commercial operation in 1986, as well as the units with full-power licenses which are scheduled for commercial service in the near future. Using Nuexco estimates, a cursory examination of the inventory situation of the five utilities that have brought units into commercial service thus far in 1986 indicates that, on average, those utilities hold uranium inventories equivalent to approximately seven times the annual U_3O_8 requirements of the units entering commercial service.

Licensing progress for new nuclear plants in 1986 is moving at about the same pace as in 1985, when eight units entered commercial operation. According to utilities' estimates, 18 reactors were scheduled to enter service in 1986, but Nuexco expects that only seven of those units will actually achieve that status. Both of Pacific Gas and Electric Company's Diablo Canyon units are now in commercial operation; Unit 1 began in May 1985 and Unit 2 began in March 1986. In addition, Arizona Public Service might be able to bring both of its first two Palo Verde units into service during 1986. Unit 1 entered the rate base in February 1986, and Unit 2 has a full-power license and is in the midst of power ascension.

In other developments, the premature criticality that occurred during the startup of Detroit Edison Company's Fermi Unit 2 a year ago has delayed the unit's commercial operation. Although the Nuclear Regulatory Commission recently voted to reinstate the operating license for the 1,100-MWe BWR, it is currently restricted to five-percent power. Detroit Edison has not scheduled a commercial operation date.

After receiving a full-power license, Duke Power Company expects its Catawba Unit 2 to begin commercial operation by the end of September 1986. If it does, the 1145-MWe PWR will have begun operation nine months ahead of schedule and at a cost that the utility estimates to be far below the US average for comparable units. Catawba Unit 1 began commercial service in June 1985. The utility's success is completing a unit under budget and well before its scheduled completion date represents an encouraging sign for the development of the US nuclear power program.

Table 2

US NUCLEAR UNITS ENTERING COMMERCIAL OPERATION OR HAVING FULL-POWER LICENSES IN 1986

Unit	Utility	Net MWe	Type	COD[1]
Entered Commercial Operation				
Three Mile Island 1[2]	General Public Utilities	819	PWR	Jan 1986
Limerick 1	Philadelphia Electric	1055	BWR	Feb 1986
Palo Verde 1	Arizona Public Service	1270	PWR	Feb 1986
Diablo Canyon 2	Pacific Gas and Electric	1106	PWR	Mar 1986
Millstone 3	Northeast Utilities	1150	PWR	Apr 1986
Has Full-Power License				
River Bend 1	Gulf States Utilities	940	BWR	Aug 1986
Catawba 2	Duke Power Company	1145	PWR	3Q 1986
Palo Verde 2	Arizona Public Service	1270	PWR	late 1986
Perry 1	Cleveland Electric	1205	BWR	late 1986
Fermi 2[3]	Detroit Edison	1100	BWR	
Hope Creek	Public Service Electric & Gas	1067	BWR	late 1986

[1] Actual or Expected Commercial Operation Date.

[2] Three Mile Island Unit 1 re-entered the rate base at the end of 1985.

[3] Fermi Unit 2 has a full-power license, but is restricted to five-percent power pending NRC review. Detroit Edison has not scheduled an expected commercial operation date.

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AUSTRALIA

The biennial National Labor Party Conference held in early July failed to produce any significant changes in Australia's strict uranium policy. A motion by the left wing of the Labor Party to halt all mining and export of uranium was defeated by a vote of 57 to 40, and the current government's policy was endorsed as expected. That policy provides for mining and export from existing uranium operations (Queensland Mines Ltd.'s Nabarlek and Energy Resources of Australia's Ranger in the Northern Territory), but prohibits development of any new projects other than the Olympic Dam (Roxby Downs) uranium-copper-gold project in South Australia.

The Australian government ban on uranium sales to France also remains in effect pending resolution of the dispute over France's nuclear weapons testing in the South Pacific. Although the ban was officially declared in early 1983 and re-affirmed at the Labor Party Conference in July 1984, it did not become effective until September 1984, when new shipments were due under the Queensland Mines (QML) contract with Electricite de France (EDF).

The contract was negotiated in 1981 and calls for 6.8 million pounds U_3O_8 to be delivered between 1982 and 1988. Subsequently, the Australian government agreed to purchase eight shipments from Queensland Mines from September 1984 to September 1986, totaling 1.6 million pounds U_3O_8. Because the ban remains in place, the government will likely be forced to purchase additional quantities of QML's uranium that had been destined for sale to EDF.

While a minority of the Labor Party continues to promulgate anti-uranium attitudes, it is increasingly clear that even the left wing has adopted a more pragmatic approach to the uranium issue, notwithstanding the Chernobyl accident in the USSR. There appears to be greater recognition of the economic importance of uranium exports, as well as greater acceptance of the argument that Australia's participation in the market is necessary in order for it to have significant influence on uranium and related nuclear non-proliferation issues. Moreover, the continuing influx of capital from a variety of organizations (including French, German, Canadian, and Japanese interests) for exploration and property acquisition reflect an international belief in the eventual rationalization of Australia's uranium policy.

Nevertheless, more uncertainties regarding further development of the Australian uranium industry have emerged as a result of the ongoing legal dispute between the US DOE and the US uranium producers. If the US producers eventually prevail in their attempts to ban or significantly limit US utility use of non-US origin uranium, the timing of ERA's expansion and the Olympic Dam startup may have to be reexamined. The subsequent loss or shrinkage of US market share would be one aspect of the problem; perhaps more serious would be the increased competition from existing suppliers resulting from the reduced demand for non-US origin uranium. Thus, the Australian industry's interest in the outcome of the current legal proceedings in the USA may well equal that of the Canadian uranium industry, whose world market share exceeds 30 percent and whose development programs are further advanced than those in Australia.

SOUTH AFRICA

Second-quarter production from Chamber of Mines' producers amounted to 2,892,000 pounds U_3O_8, a three-percent decline from the previous quarter (Table 3).

Production at most of the mines fell slightly, although Driefontein Consolidated recorded a 16-percent increase, and production increased ten percent at Hartebeestfontein. Nuexco expects 1986 uranium production in South Africa to total approximately 12.4 million pounds U_3O_8.

Although the South African economy showed signs of strengthening in the first few months of 1986, that trend has been reversed by international reactions to the state of emergency that

Table 3

**REPUBLIC OF SOUTH AFRICA:
1986 URANIUM PRODUCTION[1]
(Thousands of Pounds U_3O_8)**

Operation	First Quarter 1986	Second Quarter 1986	Year to Date
Buffelsfontein	353	300	653
Driefontein Consolidated	41	49	90
ERGO[2]	91	88	179
Harmony	231	211	442
Hartebeestfontein	238	264	502
JMS[3]	318	305	623
Randfontein	339	324	663
Stilfontein (Chemwes)	137	135	272
Vaal Reefs	1,082	1,069	2,151
Western Areas	155	147	302
TOTAL[4]	2,983	2,892	5,875

[1] Excludes Palabora Mining Company, which is not a member of the Chamber of Mines.

[2] ERGO = East Rand Gold and Uranium Company Ltd.

[3] JMS = Free State Joint Metallurgical Scheme.

[4] Columns may not add due to rounding.

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was recently reimposed. In February 1986, representatives from South Africa and its major international creditor banks reached an agreement outlining the short-term rescheduling of the nation's large debt. A similar agreement with several hundred smaller banks was reached in March. The rand responded to these measures, rising steadily from the all-time low recorded in early December 1985. However, continued violence and social unrest, followed by the reimposition of the state of emergency and increased media attention, has contributed to the rand's recent decline. Although restrictive government actions may lead to further labor unrest, including the possibility of additional mine strikes, the large uranium stockpiles held by producers will continue to keep supply channels open for the foreseeable future. Moreover, gold exports currently account for about forty percent of South Africa's exports. Thus, the importance of mining revenues to the South African economy dictates that gold, and therefore uranium, production will certainly continue.

CORRECTION

The article on page 8 of last month's Report (#215, July 1986) contained two errors regarding the enrichment status of US utilities. Rochester Gas and Electric Company should have been included in Table 1 as one of the utilities that signed the Utility Services Contract. Also, the text stated that "five US utilities (including one utility group) are not covered by the USEC." However, as Table 1 correctly showed, one of the Yankee group utilities, Public Service Company of New Hampshire, did sign the USEC; the other three Yankee utilities did not.

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THE RABBIT LAKE PROJECT

Introduction

The Rabbit Lake uranium project is located on the eastern edge of Athabasca Basin in northern Saskatchewan (Figure 2). The discovery of uranium at Rabbit Lake in 1968 was the first discovery in one of the world's richest uranium districts. That discovery was the start of extensive and highly competitive prospecting and exploration activity along the trend of the Wollaston fold belt. The activity quickly spread throughout the entire region of the Athabasca Basin, resulting in subsequent discoveries of at least 25 separate uranium occurrences, 17 of which are located along the Wollaston trend, ranging from Key Lake at the south end to Eagle Point at the north end. The district holds some of the largest and highest-grade uranium deposits found in the world.

History of the Project

Gulf Minerals Canada Limited, a subsidiary of Gulf Oil Corporation, discovered the Rabbit Lake occurrence in late 1968, the first year of active exploration in the area. Subsequent drilling indicated the presence of a major uranium deposit. Gulf sold a 49-percent interest in the project to Uranerz Canada Ltd., in 1970. Construction of a mine and mill complex began in 1972, and initial U_3O_8 production began in 1975. The project was designed for a ten-year life, with production capabilities of 4 to 5 million pounds U_3O_8 annually. Gulf continued to explore the area surrounding Rabbit Lake and by 1980 had discovered the West Bear, Horseshoe and Raven orebodies to the south of Rabbit Lake, and the Collins Bay A, B, D and Eagle Point orebodies to the north of Rabbit Lake (see Figure 2).

Eldorado Nuclear Limited purchased 100-percent interest in the Rabbit Lake project in October 1982. The project was immediately turned over to Eldor Mines, a division of Eldorado Resources Limited. (The latter is a wholly-owned subsidiary of Eldorado Nuclear Limited. Another wholly-owned subsidiary, Eldor Resources Limited, controls 16.67 percent of the Key Lake project. Figure 3 illustrates these ownership relationships.) Eldor Mines continued mining and milling at Rabbit Lake and initiated further exploration and evaluation of the Collins Bay and Eagle Point deposits. Eldor ceased mining the Rabbit Lake deposit in September 1984; the mill continued to process stockpiled ore through March 1986. However, from mid-1985 to March 1986, ore sent to the mill was blended with stockpiled ore from the Collins Bay "B" deposit to produce a more uniform feed.

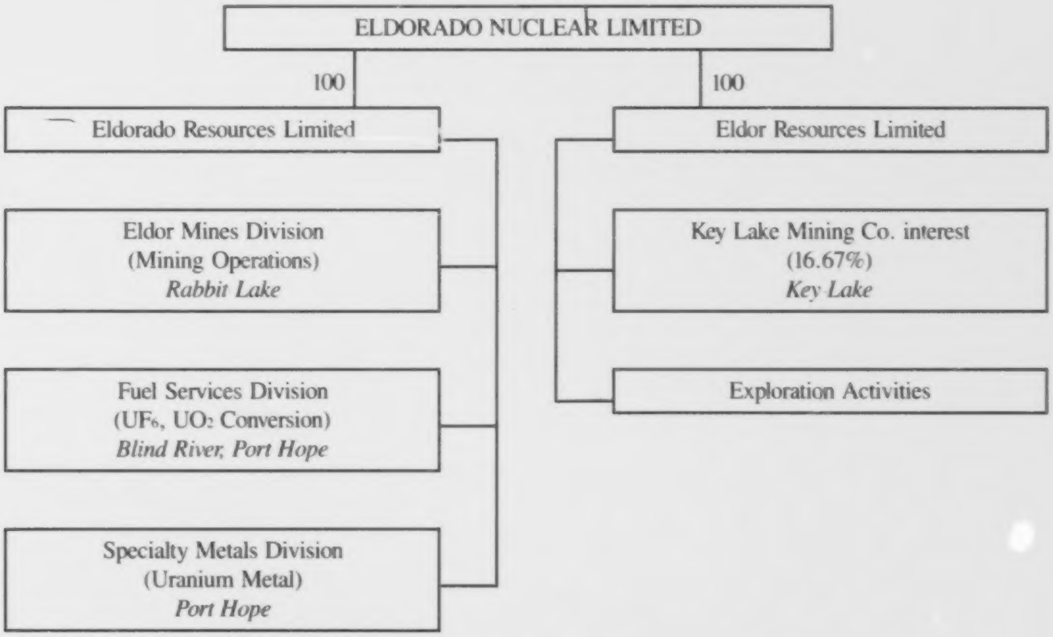
ELDORADO NUCLEAR LIMITED
100
100
Eldorado Resources Limited
Eldor Resources Limited
Eldor Mines Division
(Mining Operations)
Rabbit Lake
Key Lake Mining Co. interest
(16.67%)
Key Lake
Fuel Services Division
(UF_6, UO_2 Conversion)
Blind River, Port Hope
Exploration Activities
Specialty Metals Division
(Uranium Metal)
Port Hope

FIGURE 3. OWNERSHIP STRUCTURE OF THE ELDORADO GROUP

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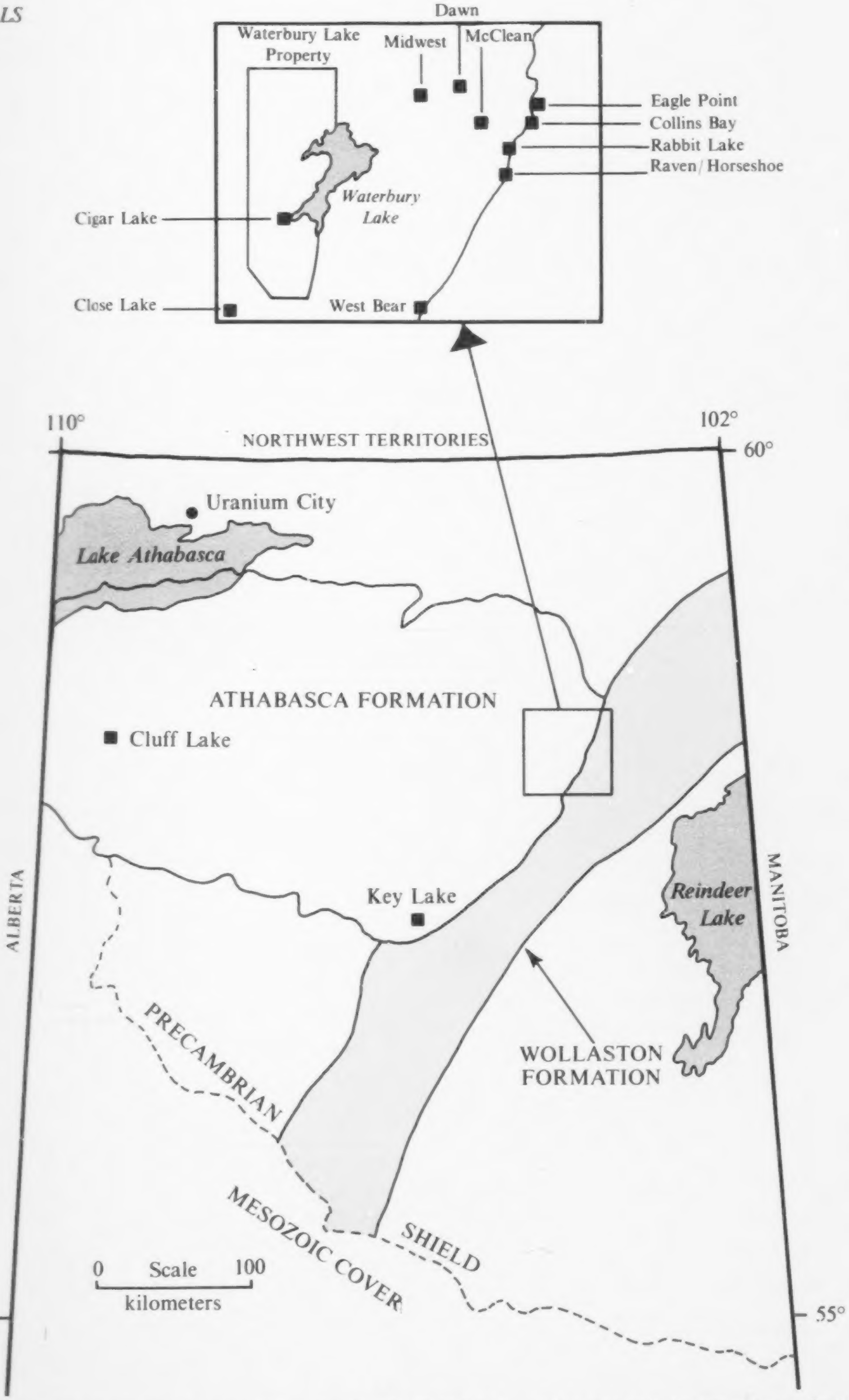
Dawn
Waterbury Lake Property
Midwest
McClean
Eagle Point
Collins Bay
Rabbit Lake
Raven/Horseshoe
Waterbury Lake
Cigar Lake
Close Lake
West Bear
110°
102°
NORTHWEST TERRITORIES
60°
Uranium City
Lake Athabasca
ATHABASCA FORMATION
Cluff Lake
ALBERTA
Key Lake
MANITOBA
Reindeer Lake
PRECAMBRIAN
SHIELD
WOLLASTON FORMATION
MESOZOIC COVER
0 Scale 100
kilometers
55°

Figure 2. Location map of northern Saskatchewan, showing the Rabbit Lake project area and other uranium projects in the district.

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reserves and accessibility of those orebodies is likely to add another 10 to 12 years of life to the mining and milling project. The reserve estimates for the deposits are illustrated in the following table:

Orebody	Estimated Metric Tons of Uranium	Average Grade in Percent	Estimated Total in Pounds U_3O_8
"B" deposit	11,110	0.62	29,000,000
"A" deposit	6,500	5.68	17,000,000
"D" deposit	2,150	2.19	5,600,000
		Total estimated reserves =	51,600,000

The three deposits are situated along the northeast-trending Collins Bay thrust fault (Figure 4). The "D" orebody is about 450 meters northeast of the "B" orebody, and the "A" orebody is an additional 1.5 kilometers to the northeast. Geologically, the position occupied by each orebody is controlled by reverse faulting and related alteration associated with the unconformity between rocks of the lower Athabasca Formation of Helikian age (1,800 to 1,450 million years) and underlying rocks of the Wollaston Group of Aphebian age (2,200 to 1,800 million years). The Wollaston Group unconformably overlies Archean basement rocks. The footwall of the thrust zone consists of metasediments, made up primarily of granitoid gneiss; the hanging wall consists of graphitic gneiss. Both units belong to the

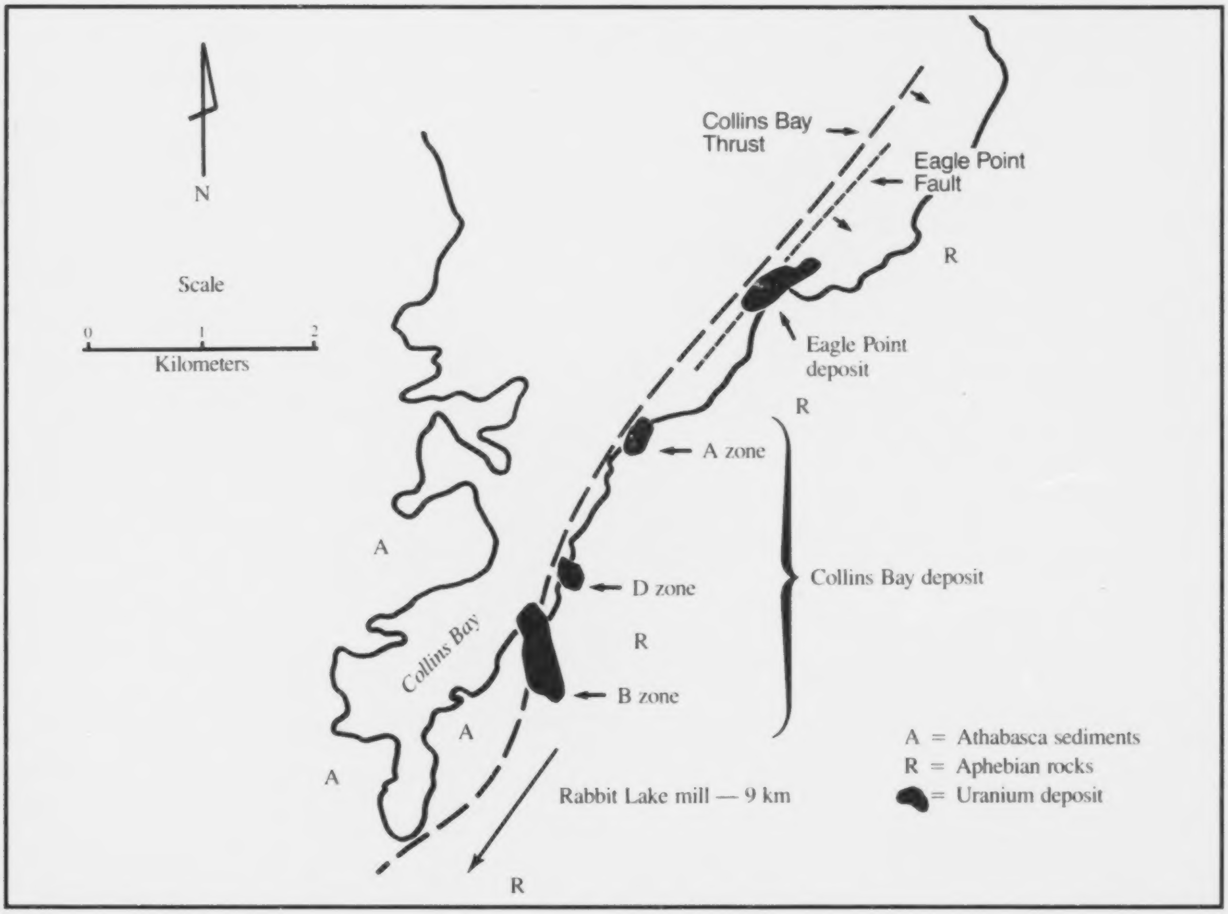
N
Scale
0
1
2
Kilometers
Collins Bay Thrust
Eagle Point Fault
R
Eagle Point deposit
R
A zone
Collins Bay deposit
A
D zone
R
Collins Bay
B zone
A
A
Rabbit Lake mill — 9 km
R
A = Athabasca sediments
R = Aphebian rocks
● = Uranium deposit

Figure 4. Geologic position of the Collins Bay and Eagle Point uranium deposits along the Collins Bay thrust and Eagle Point fault. (After Sibbald, 1983.)

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Wollaston Group. Ore deposits are situated on both sides and within the thrust zone, usually within the faulted remnant of the Athabasca Formation. However, mineralization may also occur in thin and highly altered segments of Aphebian rocks.

The actual host rock for the three Collins Bay orebodies is the Manitou Falls Formation, the lowest segment of the Athabasca Group that is present locally. Uranium mineralization is associated with a zone of intense argillic alteration and may extend downward to occupy the upper part of the regolith alteration zone at the Aphebian/Helikian contact. A halo of nickel mineralization shows close association with the uranium.

The mineral-forming process in the district followed deposition of the Athabasca sediments. Mineralization accompanied a period of widespread hydrothermal activity and associated rock alteration predated by regional tectonics and metamorphism of older rocks. Mineral accumulations occurred under favorable host conditions related to continued rock deformation and alteration. The age of mineralization is estimated at about 1,100 to 1,340 million years.

The "B" Orebody

Final evaluation and preparation of the "B" orebody was completed and stripping initiated in March 1985, and the first ore was mined and stockpiled in May. Mine production is currently progressing ahead of schedule, both in terms of tonnage mined and the average grade of ore. The "B" orebody is located nine kilometers northeast of the Rabbit Lake mill. It was discovered in 1977 by Gulf Minerals Canada Ltd., following detailed geological and geophysical studies in the immediate vicinity of the "A" orebody, discovered in 1971. Continued evaluation by geophysical techniques and diamond drilling on a number of electromagnetic conductors leading from the "A" zone led to the discovery.

Drilling revealed that the important zone of mineralization measured approximately 3000 feet long, 100 to 400 feet wide (average width is 300 feet) with an average thickness of about 100 feet. The bulk of the ore is in sandstone of the Manitou Falls Formation. The highest grade ore (2 to 4 percent U_3O_8) occurs in association with a clayey alteration product derived from Aphebian and basement rocks which were thrust, or squeezed, into the Manitou Falls sandstone. Rock alteration accompanied by high-grade ore is more pronounced where the mineral zone makes a sharp bend to the northeast at the north end of the deposit.

The orebody actually consists of a series of layered high-grade lenses enclosed by lower-grade ore. The high-grade material is usually confined to altered clay zones. Massive pitchblende is the main uranium mineral present in the clays; niccolite is the main source of nickel arsenides. However, the bulk of mineralization is confined to interstitial fillings and coatings of quartz grains in the sandstone. The main uranium minerals are pitchblende and coffenite; nickel arsenides present are gersdorffite and niccolite. Galena, chalcopyrite and pyrite are less common associated minerals.

Eldor is mining the "B" orebody using open-pit methods. Approximately 20 million tons of waste and ore will be removed, leaving a pit about 900 meters in length, up to 400 meters in width, and 60 to 70 meters in depth. The overburden, which was removed in 1985, consisted of a mantle of muskeg and glacial till 12 to 20 meters thick. It was removed and stockpiled separately for reuse around the site and final reclamation of the pit.

About 150 meters of the north end of the deposit extend into Collins Bay, covered by about 6 meters of water and 12 meters of glacial till. Dikes were installed to allow mining access to the ore (Figure 5). The main portion of the dike was constructed of interlocking steel sheet dam cells, each filled with compacted sand. Earthen dike extensions onshore, isolating the orebody from bay waters. Once the water had been pumped out, strip mining began.

The ore zone is so completely altered that mining is accomplished with little or no blasting, although ripping may be necessary. The mine rate is 1,800 tonnes of ore per day using front-end loaders for closer grade control. The mined ore is hauled from the pit using the same 27-tonne dump trucks and stockpiled nearby according to estimated grade. It is blended from stockpile to maintain a suitable yellowcake production level.

The "A" Orebody

Gulf Mineral Resources discovered the "A" orebody in 1971 during geologic reconnaissance of anomalous radioactivity in glacial material. Ground exploration led to the discovery of a mineralized boulder train; subsequent geophysical studies and follow-up drilling resulted in the ore discovery. The orebody is situated on the hanging wall of the Collins Bay thrust. It is entirely within highly altered Manitou Falls Formation immediately above the contact with Aphebian rocks and Archean granitoid and graphitic gneisses and metasediments (Figure 6). The orebody host is a lens of well-developed clay alteration. A halo of nickel mineralization surrounds the uranium mineralization.

The orebody measures about 90 meters along the thrust, 45 meters wide and only 30 meters in depth. The highest-grade uranium occurs in the center of the deposit as lenses and seams of pitchblende in hard dark clay; ore intercepts grading up to 80 percent U_3O_8 have been recovered from drill cores of this zone. Coffenite is present as a companion mineral in the lower-grade zones. Ore quality and quantity decreases with depth and completely bottoms out after penetrating about 6 meters into altered basement rock. Nickel arsenides (niccolite and rammelsbergite) are dispersed throughout the uranium, but show higher concentrations in areas of softer clays which are peripheral to the high-grade core. Traces of silver, gold and galena have been noted throughout the orebody. Uranium is the only mineral present in sufficient quantities to be of commercial interest.

The "A" orebody will be strip mined on a schedule favorable to the mining of the "B" orebody. The high-grade nature of the deposit will be beneficial to later-stage mining of the "B" orebody. The north end of the deposit extends into Collins Bay and will require the construction of dikes before mine development begins. Water depth and the thickness of the glacial till are similar to those conditions at the "B" orebody. The timing of the development is still under construction.

The "D" Orebody

The "D" orebody is the smallest of the three deposits included in the Collins Bay project. Nevertheless, it is important to the overall program. It is a small but high-grade deposit, can be strip mined with ease and is located in close proximity to the mill. Some diking may be necessary to develop the deposit fully. The mining schedule will probably coincide closely with that of the "A" orebody.

The "D" and "A" orebodies are structurally, geochemically and morphologically similar deposits. The largest part of the "D" orebody occurs in alteration clays and sandstone within the Manitou Falls Formation, all on the hanging wall of the Collins Bay thrust. It is about 120 meters long, 7 to 42 meters wide and about 28 meters thick. Minor amounts of ore occur in fragments of altered Aphebian and Archean rocks that have pushed into the Manitou Falls. In the sandstone portion, pitchblende and nickel arsenides occur as intergranular fillings and coatings of sand grains. Pitchblende forms as massive pods and vein-filling material. Massive pitchblende with niccolite is more common to the clay zones. Other minerals present in minor amounts include uraninite, coffenite, gersdorffite, galena, chalcopyrite, pyrite and graphite.

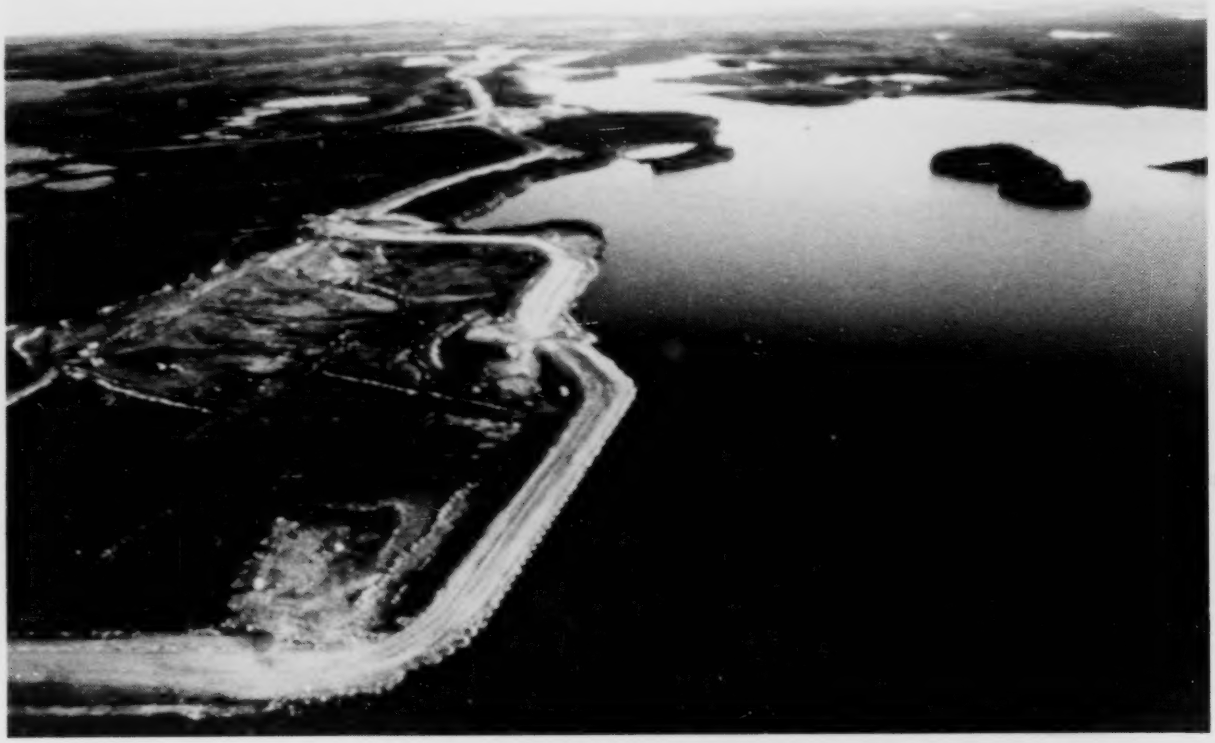

Figure 5. Photograph of overburden being stripped following the completion of dike construction on the Collins Bay "B" deposit.

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As of January 1986, Eldorado Resources' reserve position totaled an estimated 130,000,000 pounds U_3O_8 in the Collins Bay and Eagle Point South deposits alone. Its acquisition of the Rabbit Lake project and the highly successful drilling results led Eldorado Resources to initiate a C$100,000,000 program to modify the mill to process Collins Bay ores, develop the "B" orebody, prepare the mined-out Rabbit Lake pit to receive mill tailings, and complete evaluation and future development of the remaining orebodies. That program is proceeding — additions to the mill are now almost fully operational, all mill tailings are sent to the pit, and mining of the "B" orebody has progressed ahead of schedule. The status of ore reserves, combined with the size of the expenditure, indicates a project life of approximately another 25 years. Eldorado is now one of the world's largest uranium producers, having an annual capacity of 6,000,000 pounds from the Rabbit Lake project and about 2,000,000 pounds from its share of Key Lake production.

Project Format

Eldorado's modifications to the Rabbit Lake mill had a dual purpose — to maximize uranium recovery from the more complex and higher-grade Collins Bay ores, and to maintain new, more stringent environmental standards. The latter was accomplished primarily by eliminating the use of ammonia in the solvent extraction ion-exchange circuit and in the precipitation circuit. In the ion-exchange circuit, all uranium is now extracted (stripped) from the pregnant aqueous solution by the addition of strong sulfuric acid (450 g/l) rather than ammonia sulfate. The straight acid leach and strip action facilitates better extraction of Collins Bay "B" ore, which has a lower carbonate content than did Rabbit Lake ore. Yellowcake precipitation is accomplished with the addition of hydrogen peroxide instead of ammonia.

Mill waste water is treated with ferric sulfate and barrium chlorate to adjust the pH. It is then pumped to the settling pond area for final pH adjustment and removal of the last traces of radium. The overflow seeps through three separate sand filters before being released to the environment; radium-contaminated water is recycled through the mill.

The average grade of mill feed from the "B" orebody will approximate 0.60 percent uranium, compared to Rabbit Lake ores that averaged 0.35 percent. This permits a decrease in mining and crushing requirements. Reduced mill throughput requires less pumping capacity in the countercurrent decantation circuit (CCD), so lower-capacity pumps were installed for greater efficiency.

Impurities in Collins Bay ores include zircon, vanadium, molybdenum, iron and arsenic, compared to the occasional presence of molybdenum in Rabbit Lake ore. All impurities are precipitated out of the uranium-bearing solution by the addition of ferric sulfate and lime (about 250 pounds per ton) while passing through the solvent extraction circuit. Precipitated impurities are returned to the tails stream for final disposal. The commercial recovery of associated minerals is impractical due to poor yields of the other minerals, as well as their radium contamination. A large part of plant modification focused on tails preparation and permanent disposal. The uranium-free liquid stream (raffinate) from the solvent extraction circuit and the residue from the countercurrent decantation circuit (CCD) are neutralized with lime before being mixed and pumped to a newly constructed filter plant. Recovered fluids are recycled back to the mill; the filter cake is transferred to tailings disposal.

The tailings disposal plan is unique to the Rabbit Lake project. The mined-out Rabbit Lake pit is believed to be large enough to hold all tailings that may be generated during the remaining life of the project. Pit preparation began with the collaring of a tunnel into the southwest wall at the bottom of the pit for dewatering the pit. The tunnel was back-filled with large boulders, and the entire pit bottom was covered with a mantle of boulders. A five-foot thick layer of gravel was applied and covered with about ten feet of clean sand to form a multi-layered pervious envelope. The gravel and sand mantle will be layered up the pit walls as the pit fills with tailings, protecting the interior from outside forces.

The purpose of the gravel and sand pervious envelope is to contain all contaminants associated with mill tailings, allowing water in the tails to filter through the sand and flow through the gravel to the dewatering tunnel at the pit bottom. Similarly, migrating groundwater and surface water that would normally flow into the pit will flow down the gravel liner to the drain area, never making contact with the tailings inside the sand liner. The shaft contains three pump columns for lifting the water to the surface. Water recovered from the pit is recycled through the mill.

The transportation of tails from the filter plant to the pit was originally accomplished by loading the stacked filtercake on trucks and dumping the material directly into the pit. A new plan under development may accelerate the movement of material and allow greater control of the flow into the pit. The moisture content of filtercake is increased slightly to create a semi-liquid that will flow through a 10-inch pipeline leading from the end of the conveyor belt to a control point at the edge of the pit. At that point, the tailings flow into the pit is directed to create an even fill-up rate. If this method proves successful, permanent facilities will be installed.

The Collins Bay Project

The stripping and mining operations of the "B" orebody at the Collins Bay project are well underway. Project plans also include exploitation of the "A" and "D" orebodies. The combined

Eagle Point Project

The most recent discovery in the area was made at Eagle Point, located on Collins Bay about 12 kilometers northeast of the Rabbit Lake mill (and about 5 kilometers northeast of the "B" orebody). The Eagle Point deposit was discovered in 1980 during a diamond drilling program designed to test the northeast extension of the Collins Bay thrust zone. High-grade mineralization was discovered on the southeast side of the thrust, and was followed southeast where the Eagle Point fault was discovered.

Exploration and delineation drilling during the next four years outlined an orebody estimated to contain about 130 million pounds U_3O_8. The orebody dimensions are currently about 1,130 meters in length, 185 to 400 meters in width, and extend from the surface to a drilled depth of about 400 meters. Approximately 80 percent of the orebody lies directly under 10 to 15 meters of water in Collins Bay.

The deposit is divided into Eagle Point South, which is 100 percent controlled by Eldorado and contains an estimated 78 million pounds U_3O_8; and Eagle Point North, controlled equally by Eldorado, Saskatchewan Mining Development Corporation (SMDC), and Noranda Mines Limited and contains an estimated 52 million pounds. Eldorado is the operator of the joint-venture project. The entire property, but primarily Eagle Point South, is included in the long-range planning for the Rabbit Lake project.

Uranium at Eagle Point is closely associated with the Eagle Point fault, a parallel structure to the Collins Bay thrust which is located only about 45 meters to the northwest. The highest grade uranium mineralization (up to 60 percent U_3O_8) occurs as fracture fillings and as impregnations in large lenses of highly altered gneissic and intrusive rocks adjacent to the fault zone. However, uranium mineralization occurs in all rock types influenced by fault-related fracturing and rock alteration. The actual fault zone, which is only 1.5 to 3 meters wide, is filled with graphitic gouge containing only spotty mineralization. Important uranium minerals present include pitchblende and uraninite. Boltwoodite, and alteration product of uraninite, is widely distributed throughout the deposit, and coffenite occurs in minor amounts. The nickel arsenides and associated minerals common to the A, B and D deposits occur only in trace amounts in the Eagle Point deposit.

Development plans for Eagle Point are uncertain at present. It is likely that the deposit will be mined completely by underground methods because most of the deposit is under water. The next phase of planning calls for review of engineering proposals for underground exploitation. Mining will coincide with the depletion of the three Collins Bay deposits in order to maintain established production schedules, indicating that a full-scale development program could be initiated within six to eight years.

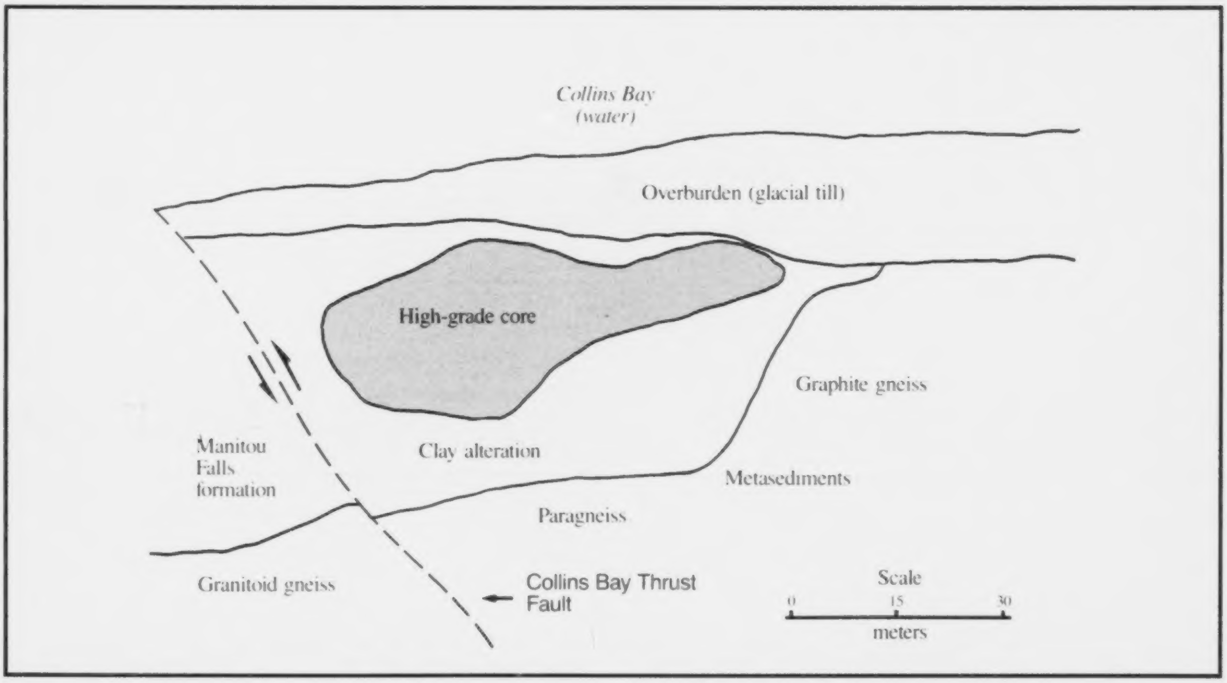

Figure 6. Vertical cross-section through the high-grade portion of the "A" orebody, showing relationship of the core to the clay alteration zone. (After Jones, 1980.)

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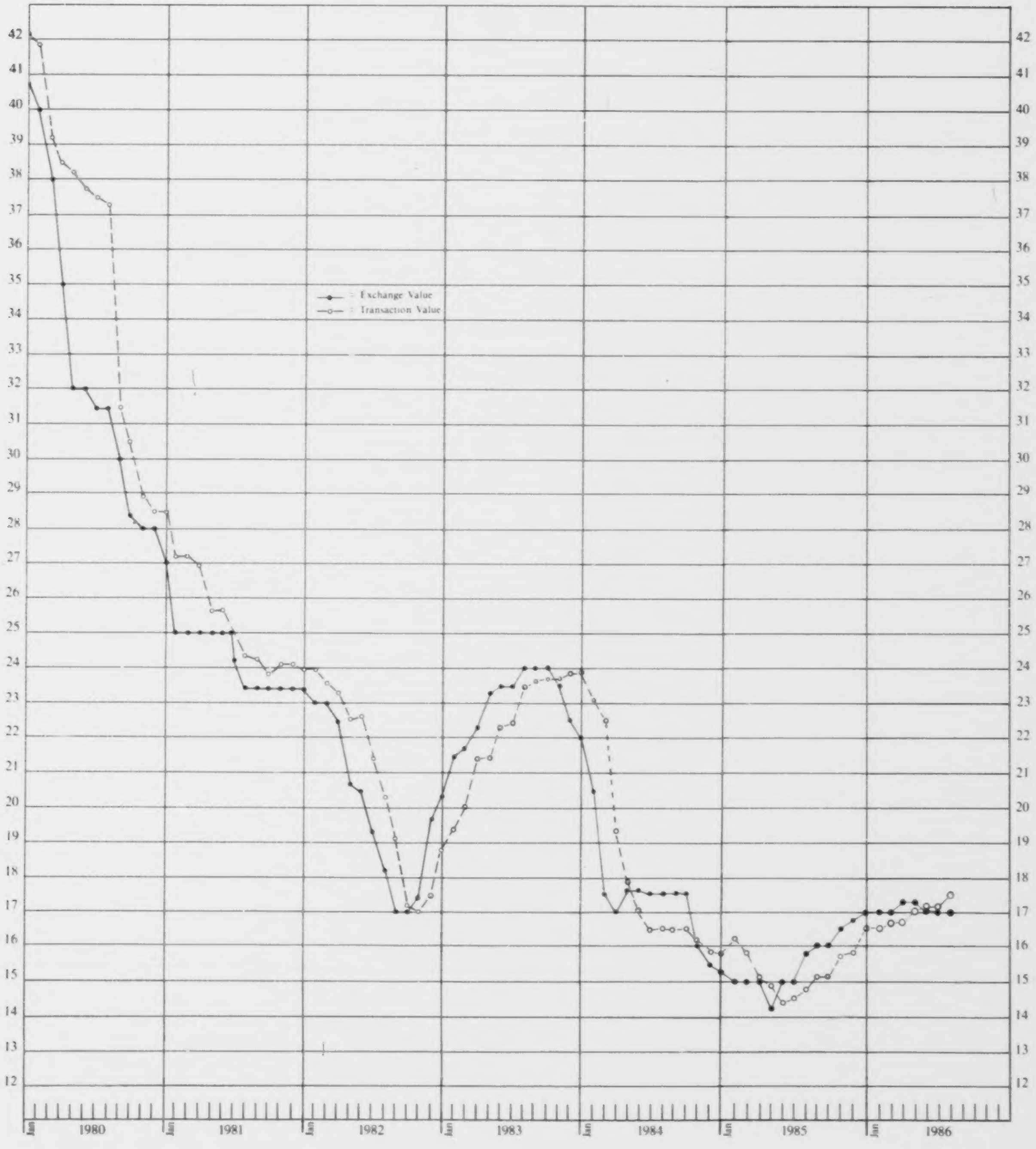
HISTORICAL MARKET DATA

EXCHANGE AND TRANSACTION VALUES SINCE JANUARY 1980

Determined as of the last day of the month indicated



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HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	32.50	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	17.00	**17.00**					

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.15	17.20	**17.50**					

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U in UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.80	1.90	1.80	1.80	**1.80**					

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GOVERNMENT STATISTICS

AUSTRALIA

	Price Index of Materials Used in Manufacturing Industry — All Groups[1] (1984 = 100)	Award Rates of Pay Indexes Australia — Adult Males In Mining Wage Earners, Weekly Rates[2] (1976 = 100)
1975 Avg.	150.4	132.6
1976 Avg.	168.4	160.9
1977 Avg.	192.0	179.0
1978 Avg.[3] [4]	198.5	190.0
1979 Avg.	248.8	127.9
1980 Avg.	321.8	140.8
1981 Avg.	355.3	154.1
1982 Avg.[5]	368.6	174.9
1983 Avg.	401.6	181.8
FY84 Avg.[6]	95.3	—
FY85 Avg.[6]	100.0	—
Jan 1985	97.0	197.8
Feb 1985	98.6	197.8
Mar 1985	102.1	197.8
Apr 1985	104.4	202.8
May 1985	107.6	202.4R
Jun 1985	108.7	202.4R
Jul 1985	111.1	202.4R
Aug 1985	110.5	202.4R
Sep 1985	108.9	202.4R
Oct 1985	108.7	202.4R
Nov 1985	109.6	209.8R
Dec 1985	110.2	209.9R
Jan 1986	109.8	209.9R
Feb 1986	108.9	209.9R
Mar 1986	99.7	209.9R
Apr 1986	94.5P	209.9R
May 1986	—	209.9

P = Preliminary R = Revised since last month

[1] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0). The basis of this index was revised to 1984 = 100. The previous index was 1969 = 100.

[2] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

[3] Monthly data for 1970-78 appear on pages 4.7 and 4.8 of Report 138.

[4] Annual averages prior to 1979 reflect index base no longer in use.

[5] Monthly data for 1979-82 appear on page 35 of Report 184.

[6] Annual averages are for financial year ending June 30.

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CANADA

	Industry Selling Price Index: All Commodities[1] (1981 = 100)	Wage-earner Data: Average Hourly Earnings (C$)[2]					
		Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells[3] (SIC 051-099)	Primary Non-ferrous Metal Industries[4] (SIC 296)	Primary Non-ferrous Metal Industries[4] (SIC 298)	Chemicals and Chemical Products[5] (SIC 372-379)
1979 Avg.[6]	217.9	—	9.60	9.66	—	—	7.67
1980 Avg.	247.2	—	10.58	10.80	—	—	8.50
1981 Avg.	288.7	—	12.02	12.23	—	—	9.53
1982 Avg.[7]	288.8	—	13.74	13.92	—	—	10.63
1983 Avg.	298.8	—	—	14.30	—	—	11.17
1984 Avg.	310.9	17.88	—	15.07	12.28	10.49	11.76
Jan 1985	117.5	18.05	16.13	15.60	12.32	10.80	12.04
Feb 1985	117.7	18.78	16.41	15.68	12.52	11.05	12.06
Mar 1985	118.4	18.24	16.21	15.57	12.44	10.97	12.02
Apr 1985	118.3	18.63	16.44	15.80	12.81	11.23	12.04
May 1985	118.6	19.41	16.51	15.63	12.76	11.25	12.15
Jun 1985	118.6	18.49	16.20	15.49	12.89	11.14	12.14
Jul 1985	118.6	18.14	16.27	15.41	12.96	11.17	12.13
Aug 1985	118.4	17.07	16.03	15.30	12.97	11.31	12.19
Sep 1985	118.6	18.53	16.55	15.72	12.95	11.39	12.26
Oct 1985	119.0R	18.74	16.51	15.70	13.14	11.53	12.33
Nov 1985	119.3R	19.05	16.66	15.88	12.76	11.32	12.49
Dec 1985	120.0R	19.07	16.57	16.01	12.51	11.09	12.59
Jan 1986	121.0R	18.15	16.22	15.86	13.11	11.48	12.52
Feb 1986	120.8R	19.52	16.57	15.99	13.20	11.59	12.45
Mar 1986	120.3R	19.04	16.65R	15.93R	13.11	11.59	12.54
Apr 1986	119.7	19.38	16.68R	15.95R	13.07R	11.64R	12.54R
May 1986	119.0	19.54P	16.66P	15.78P	12.92P	11.72P	12.38P

P = Preliminary R = Revised since last month

[1] Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Index prior to 1985, 1971 = 100.

[2] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours" (Catalogue 72-002).

[3] Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

[4] Beginning with the April 1983 figure, Primary Metal Industries, non-ferrous is split into SIC 296 and SIC 298.

[5] Chemical and Chemical Products prior to April 1983 was SIC 370-379. The new series is from a new survey which includes all companies and is based on a 1970 classification. The old survey only included companies of 20 employees or more.

[6] Monthly ISPI for 1977 and 1978 appear on page 4.10 of Report 138, and monthly wage-earner data for 1973-78 appear on page 4.11 of Report 138.

[7] Monthly data for 1979-1982 appear on page 37 of Report 184. On that page, the wage earner index entitled "Metal Mining, Including Milling (SIC 050-099)" should read "Total Mining (SIC 051-099)."

[8] Beginning with the March 1983 figure, Wage Earner Data are based on a census of all companies employing 200 or more wage earners, *plus* a random survey of companies employing fewer than 200 wage earners. Prior to March 1983 only companies employing 200 or more wage earners are included in the Wage Earner Data.

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GOVERNMENT STATISTICS

REPUBLIC OF SOUTH AFRICA

		Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1]	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100)[2]	Consumer Price Index[3] (1980 = 100)[4]	Producer Price Index All Groups[5] (1980 = 100)	Total Employment in Mining and Quarrying (Code 35)[6]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[6]
1975	Avg.	16.71	—	157.2	100.0	639,473	1,003,617
1976	Avg.	19.30	—	174.7	115.1	671,240	1,212,983
1977	Avg.	23.87	—	194.4	130.0	712,006	1,420,670
1978	Avg.	27.14	—	137.2	142.7	664,571	1,537,169
1979	Avg.[7]	30.18	—	155.3	164.5	692,209	1,830,632
1980	Avg.[8]	35.53	—	176.7	192.1	714,379	2,279,615
1981	Avg.	41.89	—	206.5	218.3	728,506	2,820,505
1982	Avg.[9]	47.25	104.2	233.5	248.7	707,552	3,246,071
1983	Avg.	51.87	115.0	262.2	274.8	696,579	3,644,772
1984	Avg.	58.95	130.3	292.8	297.9	712,080	4,196,764
Jan	1985	—	—	177.1	166.6	711,366	376,777
Feb	1985	—	—	182.8	171.3	727,932	361,823
Mar	1985	64.48	142.4	183.6	173.0	708,809	371,380
Apr	1985	—	—	187.4	174.0	724,187	369,005
May	1985	—	—	189.5	177.7	708,085	373,478
Jun	1985	67.42	148.9	191.9	179.2	724,587	395,543
Jul	1985	—	—	193.6	180.7	738,228	419,106
Aug	1985	—	—	195.6	183.2	734,121	416,777
Sep	1985	70.47	155.3	197.8	184.8	732,836	419,883
Oct	1985	—	—	200.8	188.1	720,071	401,448
Nov	1985	—	—	203.4	196.0	750,049	432,996
Dec	1985	72.43	160.1	207.4	199.4	741,372	425,261
Jan	1986	—	—	213.8	203.6	744,070	449,513
Feb	1986	—	—	215.8	206.9	754,458	438,562
Mar	1986	75.76	167.8	218.3	206.9	760,932	446,475
Apr	1986	—	—	222.2	208.9	—	—
May	1986	—	—	222.6	212.5	—	—
Jun	1986	—	—	224.4	—	—	—

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[1] Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly.

[2] Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

[3] Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."

[4] The basis for calculation prior to January 1985, 1975 = 100. For annual averages prior to 1978, April 1970 = 100.

[5] Previously known as the Wholesale Price Index, now the Producer Price Index. The computation remains the same. The basis for calculation prior to January 1985, 1975 = 100.

[6] Bulletin of Statistics, Department of Statistics, Pretoria.

[7] Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 4.9 of Report 140.

[8] Monthly data for Codes 35 and 40, 1977-1980, appear on page 28 of Report 157.

[9] Monthly data for 1979-82 appear on page 39 of Report 184.

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GOVERNMENT STATISTICS

UNITED STATES

	Producer Price Index[1]		Consumer Price Index[2]	GNP Implicit Price Deflator[3,4]	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[5]			
	Industrial Commodities (1967 = 100)	All Commodities (1967 = 100)	(1967 = 100)	(1982 = 100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980 Avg.[6]	274.8	268.8	246.8	178.64	10.26	10.63	8.30	6.94
1981 Avg.	304.1	293.4	272.4	195.51	11.55	11.98	9.12	7.62
1982 Avg.[7]	312.3	299.3	289.1	207.15	12.33	12.94	9.96	8.21
1983 Avg.	315.8	303.1	298.4	215.63	12.57	13.43	10.59	8.65
1984 Avg.	322.6	310.3	311.1	108.1	13.05	13.43	11.08	9.04
Jan 1985	322.9	309.5	316.1	—	13.29	13.70	11.39	9.33
Feb 1985	322.5	309.2	317.4	—	13.30	13.73	11.39	9.33
Mar 1985	322.6	308.7	318.8	110.4	13.29	13.95	11.37	9.39
Apr 1985	323.8	309.3	320.1	—	13.43	13.63	11.47	9.40
May 1985	325.3	309.8	321.3	—	13.24	13.60	11.44	9.39
Jun 1985	324.8	309.2	322.3	111.3	13.23	13.68	11.51	9.46
Jul 1985	324.4	309.0	322.8	—	13.45	13.83	11.59	9.47
Aug 1985	323.7	307.3	323.5	—	13.55	13.71	11.60	9.50
Sep 1985	322.3	305.5	324.5	112.1	13.44	13.68	11.65	9.54
Oct 1985	324.2	307.9	325.5	—	13.49	13.66	11.70	9.55
Nov 1985	324.7	309.5	326.6	—	13.49	13.97	11.80	9.61
Dec 1985	325.1	310.2	327.4	113.0	13.43	13.81	11.85	9.68
Jan 1986	233.8	308.9	328.4	—	13.40	13.69	11.86	9.60
Feb 1986	318.9R	304.4R	327.5	—	13.44	13.82	11.81	9.60
Mar 1986	314.0	300.3	326.0	113.5R	13.38	13.93	11.78	9.62
Apr 1986	311.3	297.9	325.3	—	13.54R	13.87R	11.82R	9.62R
May 1986	311.7	299.2	326.3	—	13.44P	13.78P	11.88P	9.64P
Jun 1986	311.6	298.9	327.9	114.1R	—	—	11.90P	9.62P

P = Preliminary R = Revised since last month

[1] US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

[2] US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items.

[3] US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

[4] The basis for calculation of this index was revised to 1982 = 100. 1984 and 1985 figures have been adjusted to that basis. The basis for calculation prior to 1984, 1972 = 100.

[5] US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for 1977-1978 are adjusted to the March 1979 benchmark. Data for January 1979 and beyond are adjusted to the March 1980 benchmark.

[6] Monthly data 1970-1978 for Producer Price Index-Industrial Commodities, Consumer Price Index, and Employment and Earnings SIC codes 10, 333, and 28, and quarterly data for GNP Implicit Price Deflator appear on pages 4.6-4.8 of Report 139.
Monthly data 1977-1978 for Employment and Earnings SIC Codes 10, 333, and 28 appear on page 33 of Report 147.
Monthly data 1970-1978 for Employment and Earnings SIC Code 36 appear on page 23 of Report 154.
Monthly data 1977-1980 for Producer Price Index-All Commodities, appear on page 21 of Nuexco Report 158.

[7] Monthly data 1979-1982 for all listed indices appear on page 41 of Report 184.

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REPRESENTATIVES AND CONSULTANTS

JAPAN

Kazy Yokota
Japan Tech Services
Ohkura Building (3F)
1-4-10 Shiba Daimon
Minato-ku, Tokyo, Japan
Telephone: (81-3) 431-6031, 6025
Telecopy: (81-3) 434-6674
Telex: 242-5060 (JATECH J)

SOUTH AFRICA

Chris I. Von Christierson
Southern Prospecting (Pty) Limited
P.O. Box 61409
Marshalltown 2107
Republic of South Africa
Street Address:
10th Floor
Eagle Star House
70 Fox Street
Johannesburg 2001
Telephone: (27-11) 838-1868
(27-11) 834-4211
Telecopy: (27-11) 834-3148
Telex: 4-89878 SA

TAIWAN

Edward Bee
Bee & Liang Company, Ltd.
14 FL Universal Business Center
NO. 663, Tun Hwa South Road
P.O. Box 1396
Taipei, Taiwan R.O.C.
Telephone: (886-2) 704-9630
TWX: 785-11570 (BEELIANG)

UNITED STATES

Harold C. Lindberg
83-A Hardee Lane
Whispering Pines, N.C. 28327
Telephone: (919) 949-3622

SPECIAL CONSULTANTS

George J. Stathakis
International Investment Banking

James C. C. Stewart
U.K. Nuclear Industry

W. Bryan Webster
International Business Development

J. Robert Wolcott
International Business Development

NUEXCO
EXECUTIVE SUMMARY
REPORT 216
(All data as of July 31, 1986)

Exchange Value
$17.00, unchanged

The **Exchange Value** is **$17.00** per pound U_3O_8, unchanged since last month.

UF_6 Value
$48.25, unchanged

The **UF_6 Value** is **$48.25** per kilogram U as UF_6, unchanged since last month.

Transactions

Seven recent natural uranium sales are reported, involving approximately 1.2 million pounds equivalent U_3O_8. All of the sales involved spot or near-term delivery, and six met the conditions for inclusion in the Transaction Value. Four of the transactions involved natural UF_6.

Supply-Demand Ratio
fell to 1.4:1

Active spot and near-term **uranium supply** amounts to **3.9 million** pounds U_3O_8 equivalent, down 175 thousand pounds since last month. Active spot and near-term **uranium demand** totals **2.7 million** pounds, up 650 thousand pounds. The spot and near-term **supply-demand ratio** fell to **1.4:1.**

Transaction Value
$17.50, up $0.30

The **Transaction Value** is **$17.50** per pound U_3O_8, up $0.30 since last month. The calculation includes 13 transactions involving a total of 2.5 million pounds U_3O_8 and equivalent UF_6, and covers a period of 3 months.

Loan Rate
unchanged at 4%

The **Loan Rate** is **4 percent** per annum, unchanged.

Conversion Value
$1.80, unchanged

The **Conversion Value** is **$1.80** per pound U as UF_6, unchanged since last month. Active secondary market supply for conversion services for delivery within three years totals 1.7 million pounds U as UF_6. Active demand totals 565 thousand pounds U as UF_6. No secondary market conversion transactions are reported.

SWU Value for
delivery within
one year: $78

The **SWU Value** at .3 tails and for delivery within one year is **$78** per SWU, unchanged since last month. No secondary market SWU transactions are reported.

* * *

Analysis and
Commentary

The Department of Energy issued its proposed criteria governing uranium enrichment, and the criteria must pass a 45-day review period in Congress in order to be adopted. Two controversial sections of the proposed criteria pertain to limitations on enrichment of foreign-origin uranium and the government's recovery of costs, topics which are certain to prompt extensive debate while before various Congressional committees.

Analysis and
Commentary

The nuclear industry in the Federal Republic of Germany may be the Western program most susceptible to anti-nuclear sentiment following the Chernobyl accident in the USSR. After years of gradually increasing acceptance, nuclear energy has resurfaced as one of the more volatile issues in German politics.

Update

During the first half of 1986, five nuclear units in the USA began commercial operation. Six other units have received full-power operating licenses, several of which may enter commercial service before the end of this year. In general, licensing progress in the USA is moving at about the same pace as in 1985, when eight units began commercial operation.

Australia

The biennial National Labor Party Conference held in early July failed to produce any significant changes in Australia's strict uranium policy. In addition, the government ban on uranium sales to France remains in effect pending resolution of the dispute over France's nuclear weapons testing in the South Pacific.

South Africa

Second-quarter production from Chamber of Mines' producers totaled approximately 2.9 million pounds U_3O_8, a three-percent decline from the previous quarter. Although the South African economy showed signs of strengthening in the first few months of 1986, that trend appears to have been reversed by international reactions to the state of emergency that was recently reimposed.

Raw Materials

The Rabbit Lake project in northen Saskatchewan represents a major part of current and future uranium production in Canada. The deposits that make up the project include the Rabbit Lake, Collins Bay and Eagle Point deposits, which are owned wholly or in part by Eldorado Resources Ltd.

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NUEXCO

NUEXCO REPORT 216 FIGURES OF THE MONTH (July 31, 1986)	This Month (Report 216)	Last Month (Report 215)	12 Months Ago (Report 204)
Exchange Value[1]	17.00	17.00	15.75
Transaction Value[1]	17.50	17.20	14.75
UF_6 Value[2]	48.25	48.25	44.00
Loan Rate[3]	4%	4%	5%
Conversion Value[4]	1.80	1.80	1.60
Near-Term Uranium Supply[5]	3.9	4.1	3.0
Near-Term Uranium Demand[6]	2.7	2.1	0.5
Near-Term Supply-Demand Ratio	1.4	2.0	6.7
Recent Uranium Sales:			
Number of Transactions[7]	7	4	8
Quantity of Material[8]	1.2	0.6	1.8
Nuexco SWU Value:[9]			
at 0.3 tails assay and delivery within one year	78	78	—
USDOE SWU Prices:			
USEC	125.00[10]	125.00[10]	135.00
AFC	153.00[11]	153.00[11]	153.00[11]
Requirements	157.00[11]	157.00[11]	157.00[11]
Market Value of Enriched UF_6[12,13]:			
2.5 w/o U_{235}	457	457	455
3.0 w/o U_{235}	585	585	585
3.5 w/o U_{235}	715	715	717
4.0 w/o U_{235}	847	847	851

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[1] US $ per pound U_3O_8 equivalent.

[2] US $ per kilogram U as UF_6.

[3] Per annum.

[4] US $ per pound U as UF_6.

[5] Active inquiries to sell, for delivery within 12 months after contract signing (millions of pounds U_3O_8).

[6] Active inquiries to purchase, for delivery within 12 months after contract signing (millions of pounds U_3O_8).

[7] Uranium sales only; does not include loans, conversion, or SWU transactions.

[8] Millions of pounds U_3O_8, equivalent.

[9] US $ per SWU.

[10] Effective 10/1/85.

[11] Effective 10/1/84.

[12] Calculated using the Nuexco Exchange Value, Conversion Value, and 0.30 percent tails assay. From 4/30/85 to 11/30/85, calculations used in the Nuexco SWU Value for DOE origin and delivery by the end of FY86. As of 12/31/85, calculations use the SWU Value for delivery within one year.

[13] US $ per KgU as UF_6, rounded to the nearest $.

INDEX TO LAST MONTH'S REPORT (215)

Topic		Page
Market Developments	Ruling on US Uranium Producers vs. DOE Lawsuit	3
	Terms of the Domenici Legislation	5
	Non-Viability of the US Uranium Industry and Implications for US Trade	6
	US Utilities and the District Court Injunction	8
Essay	History of Uranium Import Limitations in the USA	22
Analysis & Commentary	US Uranium Production Situation	23
Basic Considerations	Map of Nuclear Power Stations and Uranium Production Sites in the USA	26
Nuclear Fuel Pricing		
	Natural Uranium and Conversion Pricing in June 1986	1
	Enriched Uranium and SWUs Pricing in June 1986	2

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THE RABBIT LAKE PROJECT

Introduction

The Rabbit Lake uranium project is located on the eastern edge of Athabasca Basin in northern Saskatchewan (Figure 2). The discovery of uranium at Rabbit Lake in 1968 was the first discovery in one of the world's richest uranium districts. That discovery was the start of extensive and highly competitive prospecting and exploration activity along the trend of the Wollaston fold belt. The activity quickly spread throughout the entire region of the Athabasca Basin, resulting in subsequent discoveries of at least 25 separate uranium occurrences, 17 of which are located along the Wollaston trend, ranging from Key Lake at the south end to Eagle Point at the north end. The district holds some of the largest and highest-grade uranium deposits found in the world.

History of the Project

Gulf Minerals Canada Limited, a subsidiary of Gulf Oil Corporation, discovered the Rabbit Lake occurrence in late 1968, the first year of active exploration in the area. Subsequent drilling indicated the presence of a major uranium deposit. Gulf sold a 49-percent interest in the project to Uranerz Canada Ltd., in 1970. Construction of a mine and mill complex began in 1972, and initial U_3O_8 production began in 1975. The project was designed for a ten-year life, with production capabilities of 4 to 5 million pounds U_3O_8 annually. Gulf continued to explore the area surrounding Rabbit Lake and by 1980 had discovered the West Bear, Horseshoe and Raven orebodies to the south of Rabbit Lake, and the Collins Bay A, B, D and Eagle Point orebodies to the north of Rabbit Lake (see Figure 2).

Eldorado Nuclear Limited purchased 100-percent interest in the Rabbit Lake project in October 1982. The project was immediately turned over to Eldor Mines, a division of Eldorado Resources Limited. (The latter is a wholly-owned subsidiary of Eldorado Nuclear Limited. Another wholly-owned subsidiary, Eldor Resources Limited, controls 16.67 percent of the Key Lake project. Figure 3 illustrates these ownership relationships.) Eldor Mines continued mining and milling at Rabbit Lake and initiated further exploration and evaluation of the Collins Bay and Eagle Point deposits. Eldor ceased mining the Rabbit Lake deposit in September 1984; the mill continued to process stockpiled ore through March 1986. However, from mid-1985 to March 1986, ore sent to the mill was blended with stockpiled ore from the Collins Bay "B" deposit to produce a more uniform feed.

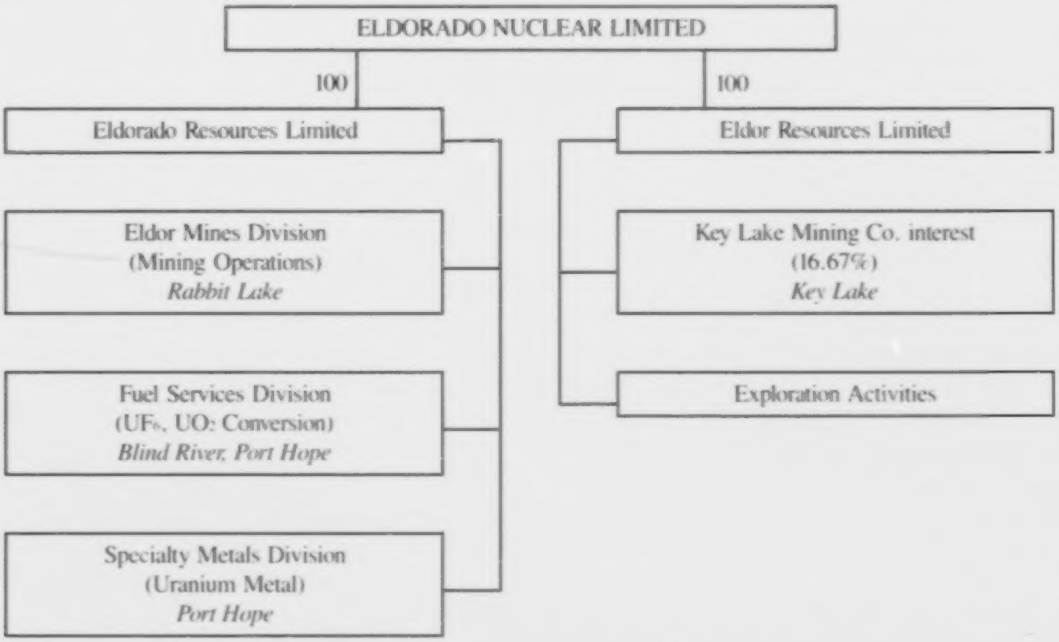
ELDORADO NUCLEAR LIMITED
100
100
Eldorado Resources Limited
Eldor Resources Limited
Eldor Mines Division
(Mining Operations)
Rabbit Lake
Key Lake Mining Co. interest
(16.67%)
Key Lake
Fuel Services Division
(UF6, UO2 Conversion)
Blind River, Port Hope
Exploration Activities
Specialty Metals Division
(Uranium Metal)
Port Hope

FIGURE 3. OWNERSHIP STRUCTURE OF THE ELDORADO GROUP

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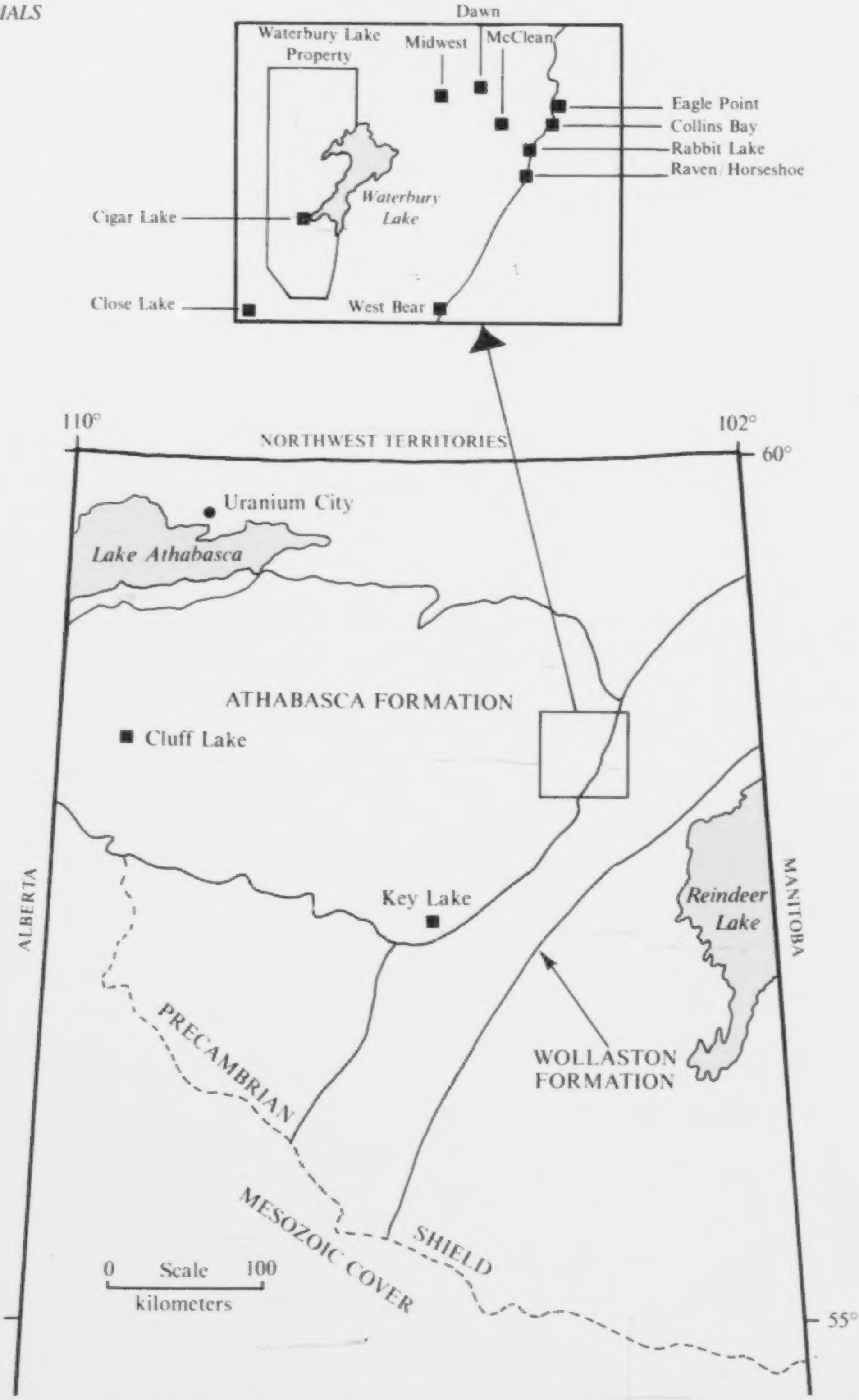
Dawn
Waterbury Lake Property
Midwest
McClean
Eagle Point
Collins Bay
Rabbit Lake
Raven/Horseshoe
Waterbury Lake
Cigar Lake
Close Lake
West Bear
110°
102°
NORTHWEST TERRITORIES
60°
Uranium City
Lake Athabasca
ATHABASCA FORMATION
Cluff Lake
ALBERTA
MANITOBA
Reindeer Lake
Key Lake
WOLLASTON FORMATION
PRECAMBRIAN
SHIELD
MESOZOIC COVER
0 Scale 100
kilometers
55°

Figure 2. Location map of northern Saskatchewan, showing the Rabbit Lake project area and other uranium projects in the district.

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As of January 1986, Eldorado Resources' reserve position totaled an estimated 130,000,000 pounds U_3O_8 in the Collins Bay and Eagle Point South deposits alone. Its acquisition of the Rabbit Lake project and the highly successful drilling results led Eldorado Resources to initiate a C$100,000,000 program to modify the mill to process Collins Bay ores, develop the "B" orebody, prepare the mined-out Rabbit Lake pit to receive mill tailings, and complete evaluation and future development of the remaining orebodies. That program is proceeding — additions to the mill are now almost fully operational, all mill tailings are sent to the pit, and mining of the "B" orebody has progressed ahead of schedule. The status of ore reserves, combined with the size of the expenditure, indicates a project life of approximately another 25 years. Eldorado is now one of the world's largest uranium producers, having an annual capacity of 6,000,000 pounds from the Rabbit Lake project and about 2,000,000 pounds from its share of Key Lake production.

Project Format

Eldorado's modifications to the Rabbit Lake mill had a dual purpose — to maximize uranium recovery from the more complex and higher-grade Collins Bay ores, and to maintain new, more stringent environmental standards. The latter was accomplished primarily by eliminating the use of ammonia in the solvent extraction ion-exchange circuit and in the precipitation circuit. In the ion-exchange circuit, all uranium is now extracted (stripped) from the pregnant aqueous solution by the addition of strong sulfuric acid (450 g/l) rather than ammonia sulfate. The straight acid leach and strip action facilitates better extraction of Collins Bay "B" ore, which has a lower carbonate content than did Rabbit Lake ore. Yellowcake precipitation is accomplished with the addition of hydrogen peroxide instead of ammonia.

Mill waste water is treated with ferric sulfate and barrium chlorate to adjust the pH. It is then pumped to the settling pond area for final pH adjustment and removal of the last traces of radium. The overflow seeps through three separate sand filters before being released to the environment; radium-contaminated water is recycled through the mill.

The average grade of mill feed from the "B" orebody will approximate 0.60 percent uranium, compared to Rabbit Lake ores that averaged 0.35 percent. This permits a decrease in mining and crushing requirements. Reduced mill throughput requires less pumping capacity in the countercurrent decantation circuit (CCD), so lower-capacity pumps were installed for greater efficiency.

Impurities in Collins Bay ores include zircon, vanadium, molybdenum, iron and arsenic, compared to the occasional presence of molybdenum in Rabbit Lake ore. All impurities are precipitated out of the uranium-bearing solution by the addition of ferric sulfate and lime (about 250 pounds per ton) while passing through the solvent extraction circuit. Precipitated impurities are returned to the tails stream for final disposal. The commercial recovery of associated minerals is impractical due to poor yields of the other minerals, as well as their radium contamination. A large part of plant modification focused on tails preparation and permanent disposal. The uranium-free liquid stream (raffinate) from the solvent extraction circuit and the residue from the countercurrent decantation circuit (CCD) are neutralized with lime before being mixed and pumped to a newly constructed filter plant. Recovered fluids are recycled back to the mill; the filter cake is transferred to tailings disposal.

The tailings disposal plan is unique to the Rabbit Lake project. The mined-out Rabbit Lake pit is believed to be large enough to hold all tailings that may be generated during the remaining life of the project. Pit preparation began with the collaring of a tunnel into the southwest wall at the bottom of the pit for dewatering the pit. The tunnel was back-filled with large boulders, and the entire pit bottom was covered with a mantle of boulders. A five-foot thick layer of gravel was applied and covered with about ten feet of clean sand to form a multi-layered pervious envelope. The gravel and sand mantle will be layered up the pit walls as the pit fills with tailings, protecting the interior from outside forces.

The purpose of the gravel and sand pervious envelope is to contain all contaminants associated with mill tailings, allowing water in the tails to filter through the sand and flow through the gravel to the dewatering tunnel at the pit bottom. Similarly, migrating groundwater and surface water that would normally flow into the pit will flow down the gravel liner to the drain area, never making contact with the tailings inside the sand liner. The shaft contains three pump columns for lifting the water to the surface. Water recovered from the pit is recycled through the mill.

The transportation of tails from the filter plant to the pit was originally accomplished by loading the stacked filtercake on trucks and dumping the material directly into the pit. A new plan under development may accelerate the movement of material and allow greater control of the flow into the pit. The moisture content of filtercake is increased slightly to create a semi-liquid that will flow through a 10-inch pipeline leading from the end of the conveyor belt to a control point at the edge of the pit. At that point, the tailings flow into the pit is directed to create an even fill-up rate. If this method proves successful, permanent facilities will be installed.

The Collins Bay Project

The stripping and mining operations of the "B" orebody at the Collins Bay project are well underway. Project plans also include exploitation of the "A" and "D" orebodies. The combined

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reserves and accessibility of those orebodies is likely to add another 10 to 12 years of life to the mining and milling project. The reserve estimates for the deposits are illustrated in the following table:

Orebody	Estimated Metric Tons of Uranium	Average Grade in Percent	Estimated Total in Pounds U_3O_8
"B" deposit	11,110	0.62	29,000,000
"A" deposit	6,500	5.68	17,000,000
"D" deposit	2,150	2.19	5,600,000
		Total estimated reserves =	51,600,000

The three deposits are situated along the northeast-trending Collins Bay thrust fault (Figure 4). The "D" orebody is about 450 meters northeast of the "B" orebody, and the "A" orebody is an additional 1.5 kilometers to the northeast. Geologically, the position occupied by each orebody is controlled by reverse faulting and related alteration associated with the unconformity between rocks of the lower Athabasca Formation of Helikian age (1,800 to 1,450 million years) and underlying rocks of the Wollaston Group of Aphebian age (2,200 to 1,800 million years). The Wollaston Group unconformably overlies Archean basement rocks. The footwall of the thrust zone consists of metasediments, made up primarily of granitoid gneiss; the hanging wall consists of graphitic gneiss. Both units belong to the

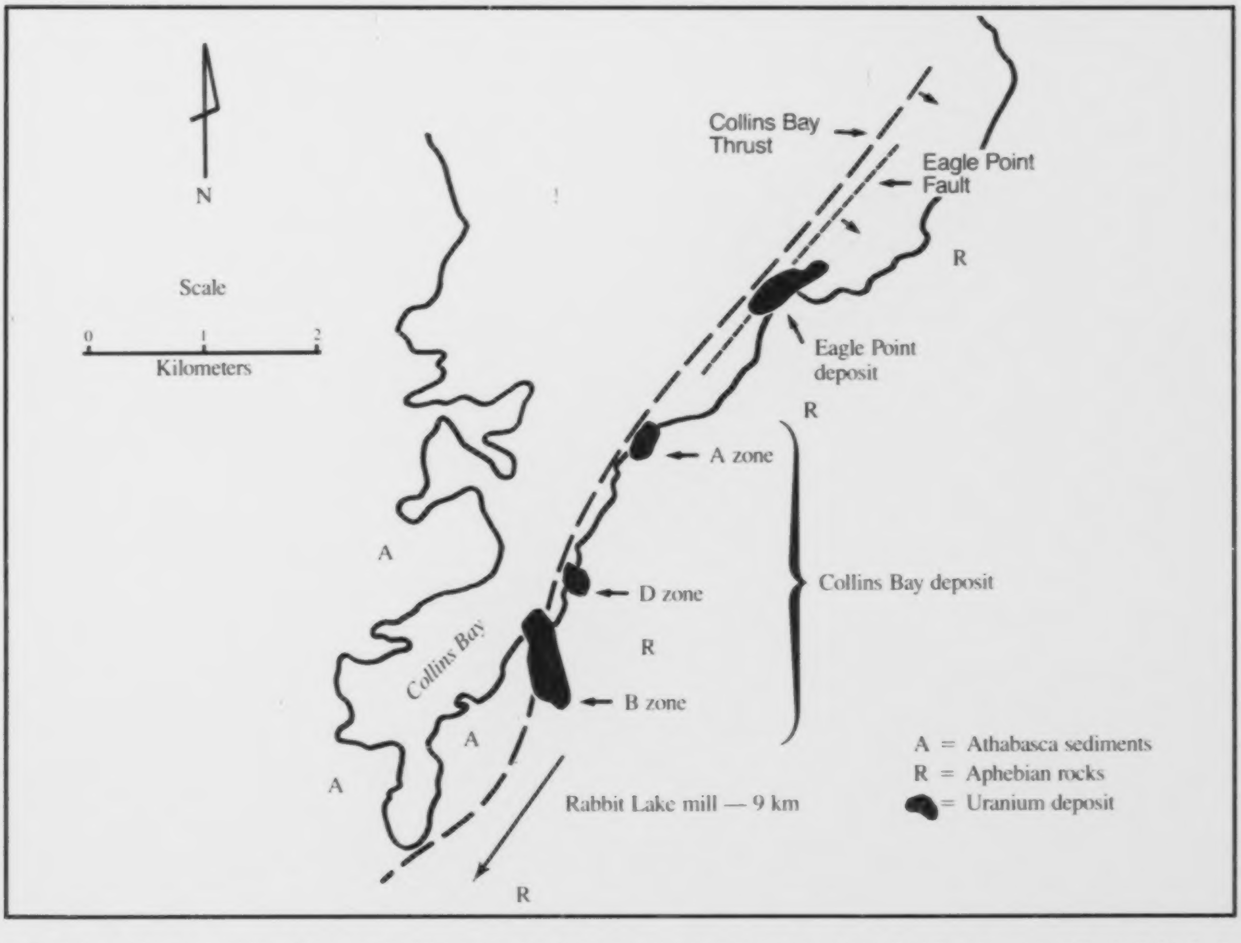
N
Scale
0
1
2
Kilometers
Collins Bay Thrust
Eagle Point Fault
R
Eagle Point deposit
R
A zone
A
D zone
Collins Bay deposit
Collins Bay
R
B zone
A
A
Rabbit Lake mill — 9 km
R
A = Athabasca sediments
R = Aphebian rocks
= Uranium deposit

Figure 4. Geologic position of the Collins Bay and Eagle Point uranium deposits along the Collins Bay thrust and Eagle Point fault. (After Sibbald, 1983.)

Wollaston Group. Ore deposits are situated on both sides and within the thrust zone, usually within the faulted remnant of the Athabasca Formation. However, mineralization may also occur in thin and highly altered segments of Aphebian rocks.

The actual host rock for the three Collins Bay orebodies is the Manitou Falls Formation, the lowest segment of the Athabasca Group that is present locally. Uranium mineralization is associated with a zone of intense argillic alteration and may extend downward to occupy the upper part of the regolith alteration zone at the Aphebian/Helikian contact. A halo of nickel mineralization shows close association with the uranium.

The mineral-forming process in the district followed deposition of the Athabasca sediments. Mineralization accompanied a period of widespread hydrothermal activity and associated rock alteration predated by regional tectonics and metamorphism of older rocks. Mineral accumulations occurred under favorable host conditions related to continued rock deformation and alteration. The age of mineralization is estimated at about 1,100 to 1,340 million years.

The "B" Orebody

Final evaluation and preparation of the "B" orebody was completed and stripping initiated in March 1985, and the first ore was mined and stockpiled in May. Mine production is currently progressing ahead of schedule, both in terms of tonnage mined and the average grade of ore. The "B" orebody is located nine kilometers northeast of the Rabbit Lake mill. It was discovered in 1977 by Gulf Minerals Canada Ltd., following detailed geological and geophysical studies in the immediate vicinity of the "A" orebody, discovered in 1971. Continued evaluation by geophysical techniques and diamond drilling on a number of electromagnetic conductors leading from the "A" zone led to the discovery.

Drilling revealed that the important zone of mineralization measured approximately 3000 feet long, 100 to 400 feet wide (average width is 300 feet) with an average thickness of about 100 feet. The bulk of the ore is in sandstone of the Manitou Falls Formation. The highest grade ore (2 to 4 percent U_3O_8) occurs in association with a clayey alteration product derived from Aphebian and basement rocks which were thrust, or squeezed, into the Manitou Falls sandstone. Rock alteration accompanied by high-grade ore is more pronounced where the mineral zone makes a sharp bend to the northeast at the north end of the deposit.

The orebody actually consists of a series of layered high-grade lenses enclosed by lower-grade ore. The high-grade material is usually confined to altered clay zones. Massive pitchblende is the main uranium mineral present in the clays; niccolite is the main source of nickel arsenides. However, the bulk of mineralization is confined to interstitial fillings and coatings of quartz grains in the sandstone. The main uranium minerals are pitchblende and coffenite; nickel arsenides present are gersdorffite and niccolite. Galena, chalcopyrite and pyrite are less common associated minerals.

Eldor is mining the "B" orebody using open-pit methods. Approximately 20 million tons of waste and ore will be removed, leaving a pit about 900 meters in length, up to 400 meters in width, and 60 to 70 meters in depth. The overburden, which was removed in 1985, consisted of a mantle of muskeg and glacial till 12 to 20 meters thick. It was removed and stockpiled separately for reuse around the site and final reclamation of the pit.

About 150 meters of the north end of the deposit extend into Collins Bay, covered by about 6 meters of water and 12 meters of glacial till. Dikes were installed to allow mining access to the ore (Figure 5). The main portion of the dike was constructed of interlocking steel sheet dam cells, each filled with compacted sand. Earthen dike extensions onshore, isolating the orebody from bay waters. Once the water had been pumped out, strip mining began.

The ore zone is so completely altered that mining is accomplished with little or no blasting, although ripping may be necessary. The mine rate is 1,800 tonnes of ore per day using front-end loaders for closer grade control. The mined ore is hauled from the pit using the same 27-tonne dump trucks and stockpiled nearby according to estimated grade. It is blended from stockpile to maintain a suitable yellowcake production level.

The "A" Orebody

Gulf Mineral Resources discovered the "A" orebody in 1971 during geologic reconnaissance of anomalous radioactivity in glacial material. Ground exploration led to the discovery of a mineralized boulder train; subsequent geophysical studies and follow-up drilling resulted in the ore discovery. The orebody is situated on the hanging wall of the Collins Bay thrust. It is entirely within highly altered Manitou Falls Formation immediately above the contact with Aphebian rocks and Archean granitoid and graphitic gneisses and metasediments (Figure 6). The orebody host is a lens of well-developed clay alteration. A halo of nickel mineralization surrounds the uranium mineralization.

The orebody measures about 90 meters along the thrust, 45 meters wide and only 30 meters in depth. The highest-grade uranium occurs in the center of the deposit as lenses and seams of pitchblende in hard dark clay; ore intercepts grading up to 80 percent U_3O_8 have been recovered from drill cores of this zone. Coffenite is present as a companion mineral in the lower-grade zones. Ore quality and quantity decreases with depth and completely bottoms out after penetrating about 6 meters into altered basement rock. Nickel arsenides (niccolite and rammelsbergite)

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are dispersed throughout the uranium, but show higher concentrations in areas of softer clays which are peripheral to the high-grade core. Traces of silver, gold and galena have been noted throughout the orebody. Uranium is the only mineral present in sufficient quantities to be of commercial interest.

The "A" orebody will be strip mined on a schedule favorable to the mining of the "B" orebody. The high-grade nature of the deposit will be beneficial to later-stage mining of the "B" orebody. The north end of the deposit extends into Collins Bay and will require the construction of dikes before mine development begins. Water depth and the thickness of the glacial till are similar to those conditions at the "B" orebody. The timing of the development is still under construction.

The "D" Orebody

The "D" orebody is the smallest of the three deposits included in the Collins Bay project. Nevertheless, it is important to the overall program. It is a small but high-grade deposit, can be strip mined with ease and is located in close proximity to the mill. Some diking may be necessary to develop the deposit fully. The mining schedule will probably coincide closely with that of the "A" orebody.

The "D" and "A" orebodies are structurally, geochemically and morphologically similar deposits. The largest part of the "D" orebody occurs in alteration clays and sandstone within the Manitou Falls Formation, all on the hanging wall of the Collins Bay thrust. It is about 120 meters long, 7 to 42 meters wide and about 28 meters thick. Minor amounts of ore occur in fragments of altered Aphebian and Archean rocks that have pushed into the Manitou Falls. In the sandstone portion, pitchblende and nickel arsenides occur as intergranular fillings and coatings of sand grains. Pitchblende forms as massive pods and vein-filling material. Massive pitchblende with niccolite is more common to the clay zones. Other minerals present in minor amounts include uraninite, coffenite, gersdorffite, galena, chalcopyrite, pyrite and graphite.

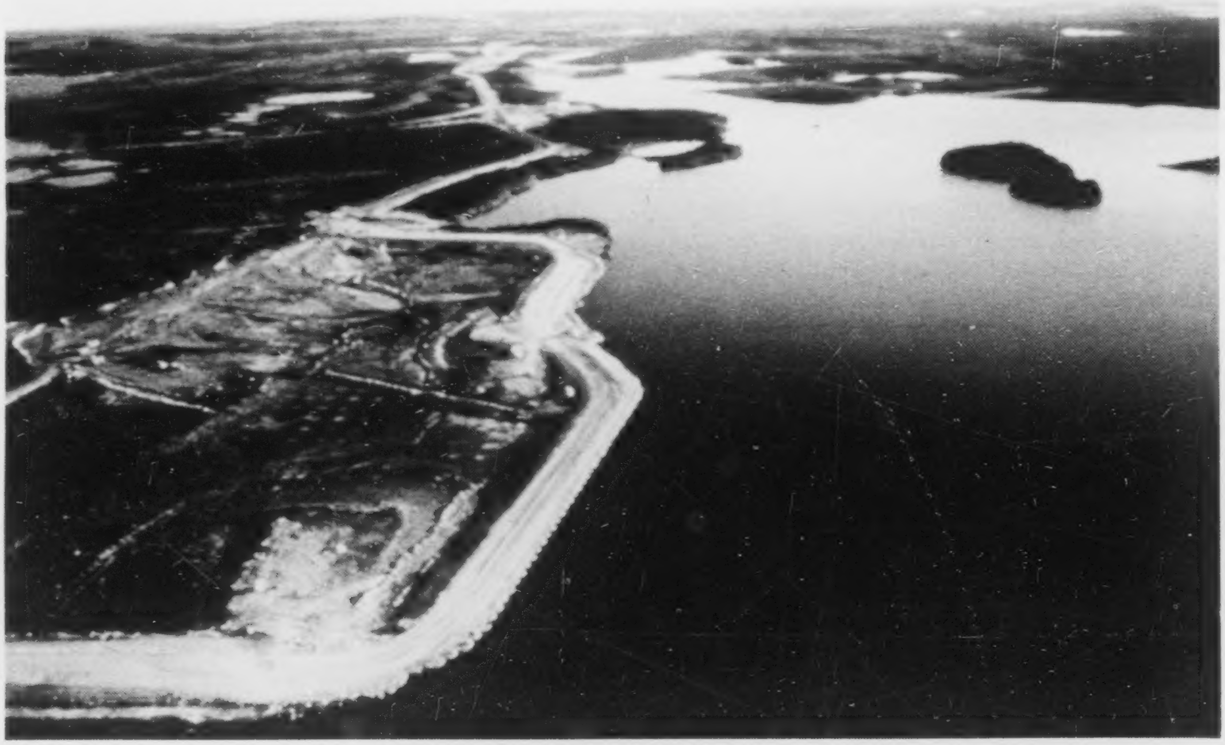

Figure 5. Photograph of overburden being stripped following the completion of dike construction on the Collins Bay "B" deposit.

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Eagle Point Project

The most recent discovery in the area was made at Eagle Point, located on Collins Bay about 12 kilometers northeast of the Rabbit Lake mill (and about 5 kilometers northeast of the "B" orebody). The Eagle Point deposit was discovered in 1980 during a diamond drilling program designed to test the northeast extension of the Collins Bay thrust zone. High-grade mineralization was discovered on the southeast side of the thrust, and was followed southeast where the Eagle Point fault was discovered.

Exploration and delineation drilling during the next four years outlined an orebody estimated to contain about 130 million pounds U_3O_8. The orebody dimensions are currently about 1,130 meters in length, 185 to 400 meters in width, and extend from the surface to a drilled depth of about 400 meters. Approximately 80 percent of the orebody lies directly under 10 to 15 meters of water in Collins Bay.

The deposit is divided into Eagle Point South, which is 100 percent controlled by Eldorado and contains an estimated 78 million pounds U_3O_8; and Eagle Point North, controlled equally by Eldorado, Saskatchewan Mining Development Corporation (SMDC), and Noranda Mines Limited and contains an estimated 52 million pounds. Eldorado is the operator of the joint-venture project. The entire property, but primarily Eagle Point South, is included in the long-range planning for the Rabbit Lake project.

Uranium at Eagle Point is closely associated with the Eagle Point fault, a parallel structure to the Collins Bay thrust which is located only about 45 meters to the northwest. The highest grade uranium mineralization (up to 60 percent U_3O_8) occurs as fracture fillings and as impregnations in large lenses of highly altered gneissic and intrusive rocks adjacent to the fault zone. However, uranium mineralization occurs in all rock types influenced by fault-related fracturing and rock alteration. The actual fault zone, which is only 1.5 to 3 meters wide, is filled with graphitic gouge containing only spotty mineralization. Important uranium minerals present include pitchblende and uraninite. Boltwoodite, and alteration product of uraninite, is widely distributed throughout the deposit, and coffenite occurs in minor amounts. The nickel arsenides and associated minerals common to the A, B and D deposits occur only in trace amounts in the Eagle Point deposit.

Development plans for Eagle Point are uncertain at present. It is likely that the deposit will be mined completely by underground methods because most of the deposit is under water. The next phase of planning calls for review of engineering proposals for underground exploitation. Mining will coincide with the depletion of the three Collins Bay deposits in order to maintain established production schedules, indicating that a full-scale development program could be initiated within six to eight years.

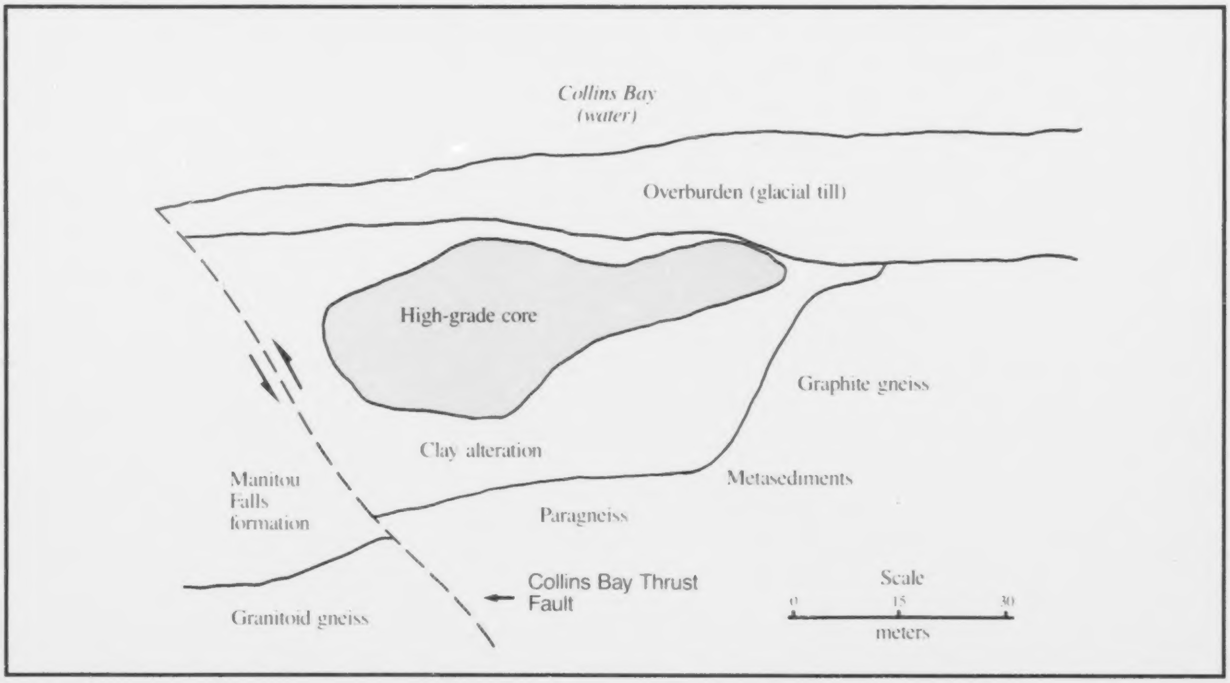

Figure 6. Vertical cross-section through the high-grade portion of the "A" orebody, showing relationship of the core to the clay alteration zone. (After Jones, 1980.)

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MONTHLY REPORT

ON THE NUCLEAR FUEL MARKET

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Three Park Central   1515 Arapahoe Street, Suite 1045   Denver, Colorado 80202

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NUEXCO FUEL BROKERAGE SERVICES

Manager of Fuel Brokerage
Earl E. Hoellen, Jr.

BROKERAGE SERVICE LOCATIONS

UNITED STATES

DENVER
Three Park Central
1515 Arapahoe Street
Suite 900
Denver, Colorado 80202
Telephone: (303) 893-4015
Telecopy: (303) 825-4821
Telex: 450202 (NUEXCO DVR)

Managing Broker
Earl E. Hoellen, Jr.

MENLO PARK
Bldg. 3, Suite 290
3000 Sand Hill Road
Menlo Park, California 94025
Telephone: (415) 854-1510
Telecopy: (415) 854-2115
Telex: 470674 (NUEXCO UI)

Managing Broker
George White, Jr.

EUROPE

FERNEY-VOLTAIRE
13 chemin du Levant
01210 Ferney-Voltaire
France
Telephone: (33-50) 428035
Telecopy: (33-50) 428526
Telex: 385288 (NUEXCO F)

Managing Broker
James E. Vaughan

ZURICH
135 Zurichstrasse
CH-8700 Kusnacht
Switzerland
Telephone: (41-01) 910-8977
Telecopy: (41-01) 910-6672
Telex: 58877 (COMAG)

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MONTHLY REPORT ON THE NUCLEAR FUEL MARKET

September 1986 No. 217

R. WESLEY MILLER, *EDITOR* CLARK M. BEYER, *ASSOCIATE EDITOR*

PRICING

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To Our Readers

Nuexco is pleased to announce that **Mr. Don A. Nichols,** located in our Denver headquarters, will lead Nuexco's activities in the brokerage of mineral properties, as well as the arranging of joint ventures and the buying, selling and financing of companies in the nuclear industry. He will work closely with Sam Freeman, John Amman, Jim Lewis, and others to assist customers in these types of transactions. Prior to joining Nuexco earlier this year, Mr. Nichols served as Vice President of Acquisitions and New Ventures for Getty Mining Company, a subsidiary of Getty Oil Company, where he negotiated agreements on uranium and other mineral properties throughout the world. Prior to his association with Getty, Mr. Nichols was an independent landman in natural resources, and during the Korean Conflict he served as a jet fighter pilot in the U.S. Marine Corps. Mr. Nichols brings over 25 years of valuable experience in land management, property acquisitions, and business negotiations to Nuexco and Concord-Nuexco International Corporation.

* * *

Included with this Report is a copy of the Raw Materials article entitled "The Rabbit Lake Project." The article was collated incorrectly in last month's Report (#216, August 1986, pages 25-31). We apologize for any inconvenience this error may have caused.

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NATURAL URANIUM AND SECONDARY MARKET CONVERSION

(All data as of August 31, 1986)

The **Exchange Value** is **$17.00** per pound U_3O_8, unchanged since last month. **Active supply** of natural uranium (concentrates and UF_6) for spot or near-term delivery totals **4,230,000** pounds U_3O_8 equivalent, up 355 thousand pounds since last month. The corresponding figure for **active demand** is **1,450,000** pounds, down 1.2 million pounds. The spot and near-term **supply-demand ratio** rose to **2.9:1.**

The *Current Market Data* section of this Report lists five natural uranium sales, involving approximately 1.5 million pounds equivalent U_3O_8. All of the transactions involved spot or near-term delivery, and four met the criteria for inclusion in the current Transaction Value calculation. Two of the transactions involved natural UF_6.

The **Transaction Value** is **$17.45** per pound U_3O_8, down $0.05 since last month. The calculation extends over a 3-month period and includes 14 transactions involving 2.6 million pounds equivalent U_3O_8.

The **UF_6 Value** is **$48.00** per kilogram U in UF_6, down $0.25 since last month.

The **Conversion Value** is **$1.90** per pound U in UF_6, up $0.10 since last month. Active supply of secondary market conversion services for delivery within three years totals 1.3 million pounds U as UF_6. Active demand totals 1.0 million pounds U as UF_6. No secondary market conversion transactions are reported.

The **Loan Rate** is **4 percent** per annum, unchanged.

* * *

The Exchange Value was unchanged this month as little buying activity was observed outside the USA during the customary vacation period in Europe. A significant amount of demand was removed from the market, either through transactions or once-active buyers leaving the market for a period of time. Several US utilities made purchases or expressed interest in US-origin uranium during August, but the premium for US material appeared to weaken as utilities increasingly have delayed buying decisions until there is some resolution of the US uranium producers' lawsuit versus DOE. Initial Circuit Court appeal hearings in that case are scheduled to begin September 11 in Albuquerque, New Mexico.

Different market segments are becoming more clearly defined as a function of the origin of the material. Canadian producers appear to dominate the seller side of the market, as US producers have effectively taken themselves out of the market by asking prices around the $19 to $20 per pound level. One US producer, however, made two sales for immediate delivery at competitive prices during August. US buyers generally have been able to obtain US-origin material through swaps, so there has been no buyer movement toward paying the higher asking prices of most US producers. Because of the decreasing number of buyers interested in material of Southern African origin, such uranium can be obtained at a substantial discount.

The UF_6 Value fell slightly as that market weakened. Some sellers of UF_6 are incorporating later deliveries, extended payment terms, and other methods to avoid cutting prices in the face of reduced demand. One transaction took place at a low price, and at least one other UF_6 seller appears willing to sell at prices around $48.00.

The Conversion Value rose to $1.90 as another potential buyer emerged. There remains a wide gap between sellers' offers and the prices the few potential buyers are willing to pay. Because of this situation, the secondary conversion market is still largely inactive.

* * *

ENRICHED URANIUM AND SWUS

The **SWU Value** as of August 31, 1986, is $78 per SWU, unchanged since last month. This refers to SWU at a tails assay of 0.30 weight-percent U_{235} and for delivery within one year. No secondary market SWU transactions are reported this month.

The secondary market for SWU remains dormant due to the general absence of buyers with near-term needs. If there is some resolution in the producers' favor of DOE's appeal proceedings in the next few weeks, some US utilities may again explore possibilities for purchasing enrichment services on the secondary market. Until that time, little market activity is anticipated.

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CURRENT MARKET DATA

August 31, 1986	Market Values	Active Supply[1] (thousands)	Active Demand[1] (thousands)
EXCHANGE VALUE	**$17.00**/lb. U_3O_8	4,230	1,450
UF_6 VALUE	**$48.00**/kgU		
CONVERSION VALUE	**$1.90**/lb. U as UF_6	1,300	1,000
SWU VALUE 0.3 tails assay; delivery within one year	**$78**/SWU		
LOAN RATE	**4%**/annum	0	0

	$/lb. U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
TRANSACTION VALUE	**17.45**	2.6	14	3

[1] Supply and demand tables in *Current Market Data* section of this Report detail the numbers for each category.

DEFINITIONS

1. The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.
2. The **UF_6 Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.
3. The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.
4. The **SWU Value** represents Nuexco's judgment of the price at which transactions for the sale of significant quantities of SWUs of stated origin for delivery in the specified time period could be concluded as of the date indicated.
5. The **Loan Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.
6. The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
   a. Transactions closed within the previous three-month period for which delivery is scheduled within one year of the transaction date;
   b. At least ten transactions;
   c. Transactions involving a sum total of at least 2 million pounds U_3O_8 equivalent.

   The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

DERIVATIONS AND COMMENTS

1. All Market Values are based on:
   a. Data from recently completed transactions.
   b. Data from pending transactions.
   c. Firm bids to buy or borrow, and firm offers to sell or lend.
   d. Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell or lend.
2. Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these Market Values.
3. In the determination of the Conversion Value, Nuexco does not consider transportation charges other than those customarily provided by primary suppliers of conversion services.
4. The prices of conversion services or SWUs delivered under long-term contracts with primary suppliers are not considered in the determination of either the Conversion Value or SWU Value.
5. For the SWU Value, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight-percent U_{235} and a product assay of 3.0 weight-percent U_{235}, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
6. In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

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CURRENT MARKET DATA

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
Country (currency)	This Month (Aug 31, 1986)	Last Month (Jul 31, 1986)	12 Months Ago (Aug 31, 1985)	This Month (Aug 31, 1986)	Last Month (Jul 31, 1986)	12 Months Ago (Aug 31, 1985)
Australia (dollar)	27.91	27.96	22.74	72.55	72.69	59.13
Belgium (comm. franc)	720.03	742.68	899.89	1,872	1,931	2,339
Canada (dollar)	23.66	23.51	21.78	61.51	61.13	56.63
Finland (markka)	83.50	85.34	94.45	217.07	221.87	245.55
France (franc)	114.25	116.44	135.82	297.02	302.71	353.11
FRG (mark)	34.86	35.89	44.46	90.64	93.30	115.58
Italy (lira)	24,021	24,648	29,840	62,450	64,080	77,576
Japan (yen)	2,651	2,640	3,793	6,893	6,864	9,862
Netherlands (guilder)	39.26	40.46	50.09	102.07	105.18	130.22
South Africa (rand)	43.93	42.43	45.71	114.20	110.30	118.85
Spain (peseta)	2,274	2,310	2,613	5,911	6,007	6,795
Sweden (krona)	117.57	118.96	132.45	305.64	309.28	344.34
Switzerland (franc)	28.13	28.80	36.45	73.12	74.87	94.77
UK (pound)	11.49	11.39	11.43	29.87	29.62	29.72
US (dollar)	17.00	17.00	16.00	44.20	44.20	41.60

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
Country (currency)	This Month (Aug 31, 1986)	Last Month (Jul 30, 1986)	12 Months Ago (Aug 31, 1985)	This Month (Aug 31, 1986)	Last Month (Jul 31, 1986)	12 Months Ago (Aug 31, 1985)
Australia (dollar)	28.64	28.78	21.46	74.47	74.83	55.80
Belgium (comm. franc)	739.09	764.53	849.27	1,921	1,988	2,208
Canada (dollar)	24.29	24.20	20.56	63.14	62.93	53.45
Finland (markka)	85.71	87.85	89.14	222.82	228.39	231.74
France (franc)	117.27	119.86	128.18	304.88	311.62	333.25
FRG (mark)	35.79	36.94	41.96	93.04	96.04	109.08
Italy (lira)	24,657	25,373	28,161	64,104	65,965	73,213
Japan (yen)	2,721	2,718	3,580	7,075	7,066	9,307
Netherlands (guilder)	40.30	41.65	47.27	104.77	108.27	122.89
South Africa (rand)	45.09	43.67	43.14	117.22	113.54	112.16
Spain (peseta)	2,334	2,378	2,466	6,067	6,183	6,412
Sweden (krona)	120.68	122.46	125.00	313.74	318.38	324.97
Switzerland (franc)	28.87	29.65	34.40	75.06	77.07	89.44
UK (pound)	11.79	11.73	10.79	30.66	30.49	28.05
US (dollar)	17.45	17.50	15.10	45.37	45.50	39.26

[1] Calculated using currency exchange rates published in the *Wall Street Journal* on Aug. 29, 1986.

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CURRENT MARKET DATA

CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U as UF_6 This Month (Aug 31, 1986)	per lb. U as UF_6 Last Month (Jul 31, 1986)	per lb. U as UF_6 12 Months Ago (Aug 31, 1985)	per kg. U as UF_6 This Month (Aug 31, 1986)	per kg. U as UF_6 Last Month (Jul 31, 1986)	per kg. U as UF_6 12 Months Ago (Aug 31, 1985)
Australia (dollar)	3.12	2.96	2.27	6.88	6.53	5.01
Belgium (comm. franc)	80.47	78.64	89.99	177.42	173.36	198.39
Canada (dollar)	2.64	2.49	2.18	5.83	5.49	4.80
Finland (markka)	9.33	9.04	9.45	20.57	19.92	20.82
France (franc)	12.77	12.33	13.58	28.15	27.18	29.94
FRG (mark)	3.90	3.80	4.45	8.59	8.38	9.80
Italy (lira)	2,685	2,610	2,984	5,919	5,754	6,578
Japan (yen)	296.32	279.55	379.33	653.27	616.29	836.27
Netherlands (guilder)	4.39	4.28	5.01	9.67	9.44	11.04
South Africa (rand)	4.91	4.49	4.57	10.82	9.90	10.08
Spain (peseta)	254.11	244.63	261.35	560.22	539.32	576.18
Sweden (krona)	13.14	12.60	13.25	28.97	27.77	29.20
Switzerland (franc)	3.14	3.05	3.65	6.93	6.72	8.04
UK (pound)	1.28	1.21	1.14	2.83	2.66	2.52
US (dollar)	1.90	1.80	1.60	4.19	3.97	3.53

SWU VALUE AND UF_6 VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	SWU Value delivery within one year (Aug 31, 1986)	UF_6 Value per kg.U in UF_6 This Month (Aug 31, 1986)	UF_6 Value per kg.U in UF_6 Last Month (Jul 31, 1986)
Australia (dollar)	128.04	78.79	79.36
Belgium (comm. franc)	3,304	2,033	2,108
Canada (dollar)	108.56	66.81	66.74
Finland (markka)	383.10	235.76	242.22
France (franc)	524.19	322.58	330.48
FRG (mark)	159.97	98.44	101.86
Italy (lira)	110,216	67,825	69,958
Japan (yen)	12,165	7,486	7,493
Netherlands (guilder)	180.14	110.85	114.83
South Africa (rand)	210.55	124.03	120.41
Spain (peseta)	10,432	6,420	6,557
Sweden (krona)	539.42	331.95	337.65
Switzerland (franc)	129.05	79.42	81.74
UK (pound)	52.72	32.44	32.34
US (dollar)	78.00	48.00	48.25

[1] Calculated using currency exchange rates published in the *Wall Street Journal* on Aug. 29, 1986.

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RECENT TRANSACTIONS[1]

Uranium Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price as Percent of Current Exchange or UF_6 Value	Seller	Buyer	Remarks
3792	1986	301-600	R[2]	Producer	Trader	UF_6.
3790	1987	301-600	R[2]	Producer	Utility	UF_6.
3788	1986	101-300	100	Producer	Utility	
3786	1986	50-100	100	Producer	Utility	
3785	1986	301-600	less than 100	Producer	Utility	

[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] The notation *R* means that Nuexco either does not know, or that Nuexco has restricted that information to protect client confidentiality.

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CURRENT MARKET DATA

URANIUM SUPPLY
(August 31, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8)		Remarks
	Spot or Near-term[2]	Intermediate or long-term	
Available for Sale: **ACTIVE**			
2335	400	—	
2703*	130	—	
		UF_6	
2740	100	—	
2764	260	—	UF_6
2765	260	—	UF_6
2777	500	—	
2885B*	325	—	UF_6
2889	100	—	
2933*	300	300 per year	
2967	100	—	
2973	15	—	
2989	40	—	
3023	500	500	UF_6
3121	1,200	—	
2263	—	400 per year	1987 on
2625	—	500 per year	1987 on
2781	—	250 per year	1988-95
2927	—	220 per year	1987-90
2981	—	600 per year	1988-91
TOTAL:	4,230		
INACTIVE			
2297	200	200 per year	1988-89
2336	250	250 per year	1987-94
2389	75	75 per year	1987-90
2810	195	175	UF_6
2813	30	—	
TOTAL:	750		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2853, 3010.

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URANIUM DEMAND
(August 31, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or long-term	Remarks
Inquiries to Purchase:			
ACTIVE			
2782	600	700	1988
2784	100	—	
2857*	200	300	1988-95
2951	250	100 per year	1987-91
3014*	200	—	
3018*	100	—	
2738	—	1,000	1989-on
2760	—	750 per year	1987-90
3019*	—	200	1988-91
TOTAL:	1,450		
INACTIVE			
2661	250	250 per year	1986-87
2798	70	—	
2877*	300	—	
2893*	200	—	
2681*	—	500	UF_6 or U_3O_8; 1988
2733*	—	500	1988
TOTAL:	820		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2661, 2928, 2934, 3072.

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CURRENT MARKET DATA

LOAN SUPPLY AND DEMAND
(August 31, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8)		Remarks
	Within 1 Year	Beyond 1 Year	
Available for Loan:			
INACTIVE			
1938	2,000	—	UF_6
2036	500	—	
2667	800	—	
2920	2,000	—	
TOTAL:	5,300		

*New or revised since last month.

[1] Measured from the date of this Report.

Projects removed since last month: None.

No inquiries to borrow are reported this month.

CONVERSION SUPPLY AND DEMAND
(August 31, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U as UF_6)		Remarks
	Within 3 Years	Beyond 3 Years	
Available for Sale:			
ACTIVE			
2849	550	500	1987-90
2859	750	750	
TOTAL:	1,300		
Inquiries to Purchase:			
ACTIVE			
2833	400	—	
2931*	600	—	
TOTAL:	1,000		

*New or revised since last month.

[1] Measured from the date of this Report.

Projects removed since last month: 2974, 2988.

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SWU SUPPLY AND DEMAND
(August 31, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of SWUs) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
2571	—	55	1987
2855	250	—	
3026	15	—	
TOTAL:	265		
INACTIVE			
2410A	340	—	
2873*	40	—	
2953*	200	—	
TOTAL:	580		
Inquiries to Purchase:			
INACTIVE			
2879	250	—	
2878	60	—	
2999*	—	300	
3015*	85	—	
TOTAL:	395		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes SWUs deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: None.

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ANALYSIS AND COMMENTARY

NUCLEAR ELECTRIC GENERATING CAPACITY FORECAST

The following article presents Nuexco's forecast of nuclear electric generating capacity through the year 2000. Tabular data are presented for the reference case on a country-by-country basis. This article is an example of the analysis used in Nuexco's Uranium Market Study and Price Forecast.

Summary (Reference Case)

Installed nuclear power plant capacity is projected to grow from 230 gigawatts (GWe) at the end of 1986 to 348 GWe by the end of the year 2000.[1] This represents an annual compound growth rate of 2.8 percent, a figure slightly lower than the expected growth in electricity demand. The largest annual additions occur in the early years of the study. Between 1986 and 1990, additions of approximately 14 GWe per year are forecast. This growth pattern is a residual effect of the rash of plant orders that occurred in the early 1970s. By contrast, only approximately 8 GWe per year are forecast to be added between 1995 and 2000; much of that quantity is neither under construction nor ordered, so that figure is considerably less certain than capacity additions projected for the first ten years of the study period. Furthermore, most of this projected growth is concentrated in the few countries that are likely to sustain strong nuclear power programs. Thus, political setbacks in these countries could have disproportionately negative effects on the growth of nuclear power in the later years of the forecast period. Conversely, further negative developments in other countries (such as Finland or Sweden) would have little effect on the Nuexco forecast, except to the extent that they cause premature shutdowns of operating units. Tables 1 and 2 present Nuexco's current forecasts of installed nuclear generating capacity for the 1986 to 2000 period, divided into regions and countries, respectively. Figure 1 presents the information from Table 1 in graph form.

Methodology

Nuexco has considered numerous factors in creating the installed nuclear capacity forecast used in this study. Among these factors are:

- — Electricity demand growth rates;
- — Political environments;
- — Financial strength of operating entities;
- — National energy plans;
- — Construction experience in each country;
- — Operating entities' schedules for completion;
- — Construction progress;
- — Construction management expertise;
- — Licensing backlog;
- — Public acceptance of nuclear power;
- — Projected plant life.

The relative importance of these factors to the future development of nuclear power varies greatly from one country to another. For instance, in developing countries, financial capability is often the major determinant in scheduling power plant additions. In other countries, such as Japan, the rate of electricity demand growth may be the most important factor.

Europe

Most European countries, which in the past have relied heavily on oil (or, in some countries, hydropower) for electric power generation, have determined that they have no real alternatives to these sources other than nuclear power and coal. Imported coal is costly; and indigenous coal, where available, can be equally expensive. Moreover, in recent years the deleterious environmental effects of coal-generated electricity have become major political issues in some countries. While the Siberian and African pipelines provide natural gas at prices equal to or better than current oil prices, supplies of both natural gas and hydropower in Europe generally are insufficient to provide adequate baseload generation. Thus, based on comparative economics, European nations generally prefer nuclear power as a source of electrical energy. However, public reaction to the Chernobyl accident has greatly strengthened political and societal opposition to nuclear power. Moreover, anti-nuclear forces had already been gaining strength in several countries, so their gains in the wake of the Chernobyl disaster will find expression in more delays and cancellations.

France

By 1990, France will have reduced its dependency on coal and oil to small percentages of overall electricity generation. The vast nuclear power program undertaken in the early 1970s has resulted in France now being dependent on nuclear power for over 60 percent of its electricity. The steady increases in nuclear capacity over the last decade, combined with better reactor performance, have put France well on the way to energy independence. In fact, capacity surpluses seem inevitable, and Electricite de France (EDF) is rapidly becoming a major electricity exporter.

Over the past few years, the growth of the French nuclear program has begun to slow, primarily due to the continuation of

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[1] The corresponding figure in Nuexco's forecast as of 1/1/85 was 350 GWe.

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low rates of load growth and financial problems stemming from loans used to build reactors. Only one new reactor per year will likely be ordered during the period 1986 to 1989. Italy and Spain already take some electric power from France's Tricastin plants as a result of renegotiating their Eurodif enrichment contracts. France can be expected to continue promoting the export of low-cost electricity generated by nuclear power, especially since it will be able to expand its market to the United Kingdom by means of the grid link under the English Channel.

So far during 1986, EDF has put two new PWRs into commercial operation and two other units will probably enter commercial operation by the end of the year. Including the Superphenix commercial demonstration breeder reactor, which was connected to the grid in January of this year, installed nuclear generating capacity in France will total 42.7 GWe. Nuexco expects that figure to grow by 1999 to 69 GWe, approximately 50 percent of Europe's total, and 20 percent of the world total.

Federal Republic of Germany (FRG)

Germany is Europe's largest producer and user of electricity because of its huge industrial base. Oil and natural gas use have been reduced drastically, leaving coal and nuclear-based generation to supply most of the country's needs. The FRG's indigenous coal resources had been the main source of electricity generation until recently. Rapid growth in nuclear capacity in the early 1980s, however, brought a balance to coal and nuclear generation, with each providing about 30 percent of the nation's electricity in 1985.

Three Kraftwerk Union units entered commercial operation during 1985, increasing installed nuclear capacity to 16 GWe. Nuexco expects two additional units, having a combined capacity of 1.5 GWe, to begin commercial operation in 1986. After that time, four more units will increase installed capacity to 22.6 GWe by 1990; a fifth unit will raise installed capacity to 23.8 GWe by 1999 or 2000.

However, the German political situation, especially after Chernobyl, and the resultant regulatory and licensing problems will severely hamper its nuclear program for years, and the climate for new orders and the completion of units under construction appears more unfavorable than perhaps at any other time. One example: local regulatory authorities have promised to deny an operating license for the Kalkar breeder reactor.

The electoral power of the anti-nuclear sentiment raised by Chernobyl will not become evident until the next federal elections in January 1987, and until then several projects either planned or in development by the German nuclear industry will probably not advance. At present, it seems clear that the main opposition party in the FRG, the Social Democrats (SPD), will adopt an anti-nuclear platform, possibly including a call for the gradual phase-out of nuclear power. The Green Party and coal miners' unions will also add to the anti-nuclear forces at work in the FRG. Ultimately, there will almost certainly be pressure within the governing coalition to take concrete steps to moderate the current pro-nuclear policies. Nuexco's reference case forecast does not allow for an election victory by the SPD, but the low case forecast does. It is entirely possible that the current government will withdraw support for one or more controversial projects in a simple effort to retain power in the upcoming elections.

United Kingdom

The United Kingdom has indigenous sources of both oil and coal, the latter usually providing as much as 80 percent of the country's electricity. Although the UK has a diversified generating base, its success with nuclear power performance and capacity has been limited considering the scope of the program. Nevertheless, the AGR program is quickly coming to a close. By January 1986, all but four AGR units were in commercial operation. Two units at Heysham and two at Torness Point are still under construction, but are expected to be operational by 1989.

Following a two-year public inquiry that ended in February 1985, the CEGB is now awaiting the inspector's report on the Sizewell PWR program. This report will be studied by the government and probably debated in Parliament. It is unlikely that any formal decision on the construction of the Sizewell unit can be expected before the end of 1986. Nuexco expects the final decision to be delayed even beyond 1986. It is projected that only one PWR will begin operation by 2000.

Spain

Spain needs nuclear power to reduce its dependency on imported oil, but the Spanish program continues to suffer from problems with the structure of the nation's electricity industry as well as some utilities' weak financial conditions, partly brought on by an ambitious nuclear construction program in the 1970s. In 1984, a new Socialist government reviewed the nuclear program, and five plants under construction were canceled. Later that year, the government and the electricity industry attempted to redistribute ownership of the country's nuclear plants among those utilities in the best financial condition. Nevertheless, a more financially secure electricity industry will be required before additional nuclear plants can be ordered. Two units attained commercial operation in 1985, and two additional units are under active construction. These units are forecast by Nuexco to enter into operation in 1988 and 1989. Two additional units are forecast to begin operation in the 1996-2000 period, a

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ANALYSIS & COMMENTARY

FIGURE 1

NUCLEAR GENERATING CAPACITY FORECAST
Reference Case
(GWe or Thousands of MWe Net)

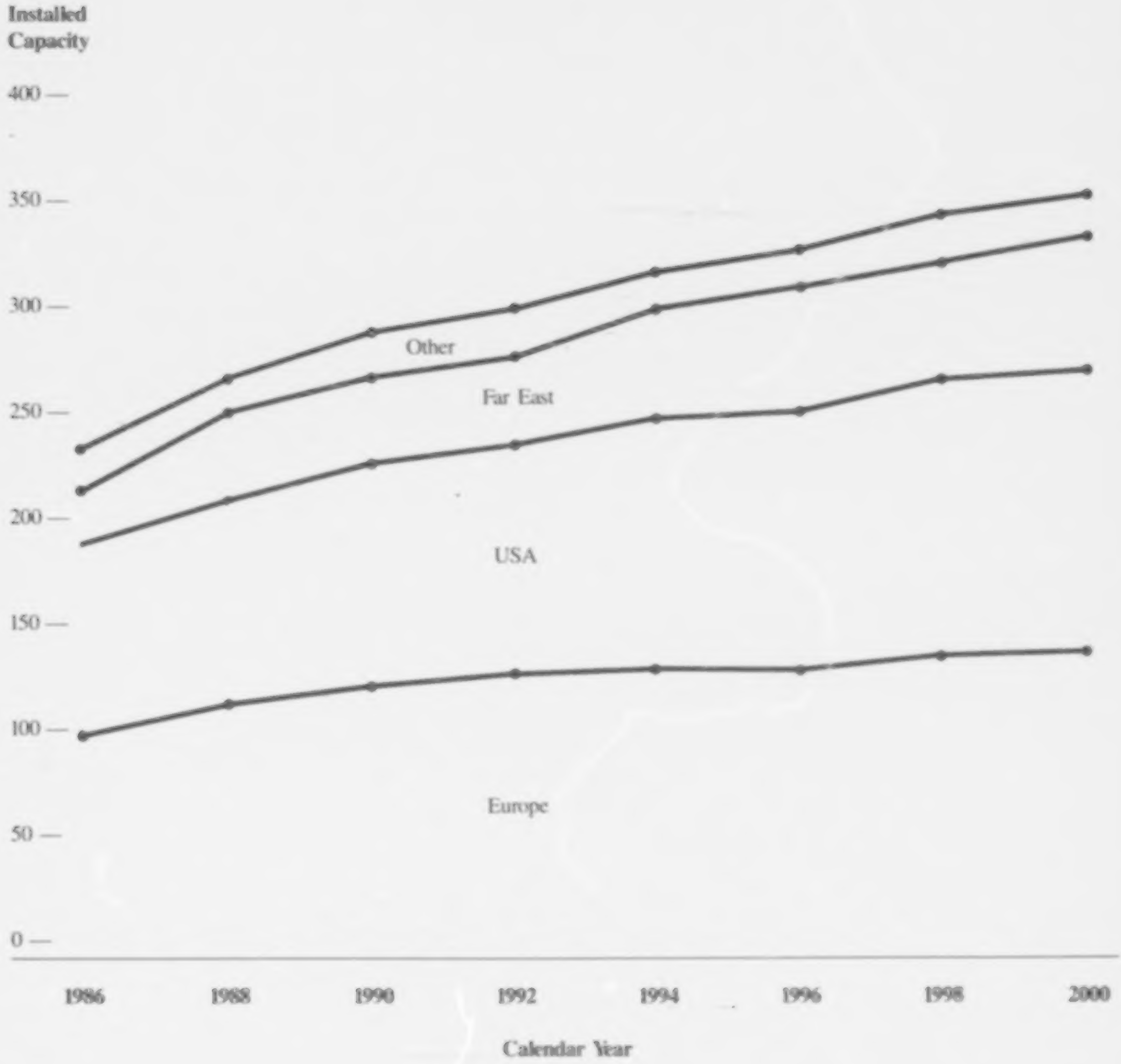

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Table 1

NUCLEAR GENERATING CAPACITY[1] FORECAST
Reference Case
(GWe or Thousands of MWe Net)

Region	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
United States	82.3	90.4	98.0	101.5	105.1	105.1	105.1	106.1	106.1	106.1	105.9	107.1	108.3	108.3	108.3
Europe[2]	98.5	104.1	109.6	115.0	120.0	121.2	125.9	126.8	129.5	129.4	132.9	133.9	140.2	143.3	143.3
Far East[3]	33.1	34.0	38.1	38.1	41.0	42.9	44.0	46.5	47.6	50.1	51.9	54.8	59.9	65.8	69.0
Other Nations[4]	15.9	16.7	17.6	18.5	18.5	19.3	20.9	22.0	23.2	24.1	25.4	26.2	25.8	25.8	27.3
TOTAL[5]	230	245	263	273	285	289	296	301	306	310	316	322	334	343	348

[1] Installed as of year end

[2] Austria, Belgium, Finland (two Swedish-supplied plants), France, Germany (FRG), Italy, Netherlands, Portugal, Spain, Sweden, Switzerland, United Kingdom, and Yugoslavia

[3] China (PRC), Japan, Korea, Philippines, Taiwan

[4] Argentina, Brazil, Canada, India, Mexico, Pakistan, South Africa, and Turkey

[5] Total consists of the nations with nuclear-electric power listed in Footnotes 2, 3, and 4 plus the USA; nuclear-electric nations excluded are Bulgaria, Cuba, Czechoslovakia, Germany (GDR), Finland (two USSR-supplied plants), Hungary, Poland, Rumania, and the USSR. Columns may not add, due to rounding.

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ANALYSIS & COMMENTARY

TABLE 2A

NUCLEAR GENERATING CAPACITY FORECAST: 1986-1993

Reference Case
(Electrical Megawatts Net)

REGION	1986	1987	1988	1989	1990	1991	1992	1993
United States	82,306	90,431	98,004	101,524	105,051	105,051	105,051	106,106
Europe								
Austria	—	—	—	—	—	—	—	—
Belgium	5,450	5,450	5,450	5,450	5,450	5,450	5,450	5,450
Finland (TVO only: excludes 2 units supplied by USSR)	1,426	1,426	1,426	1,426	1,426	1,426	1,426	1,426
France	42,738	47,008	49,558	50,833	54,663	55,928	59,738	59,738
Germany (FRG)	17,632	17,632	18,922	21,371	22,601	22,601	22,601	22,601
Italy	1,285	1,285	1,285	1,325	1,325	1,325	2,307	3,289
Netherlands	500	500	500	500	500	500	500	500
Portugal	—	—	—	—	—	—	—	—
Spain	5,637	5,637	6,634	7,616	7,616	7,616	7,616	7,616
Sweden	9,493	9,493	9,493	9,493	9,493	9,493	9,493	9,493
Switzerland	2,925	2,925	2,925	2,925	2,925	2,925	2,925	2,925
United Kingdom	10,768	12,088	12,748	13,408	13,408	13,358	13,258	13,158
Yugoslavia	615	615	615	615	615	615	615	615
Subtotal Europe	98,469	104,059	109,556	114,962	120,022	121,237	125,929	126,811
Far East:								
China (PRC)	—	—	—	—	—	300	300	300
Japan	23,653	23,653	26,901	26,901	28,766	30,361	31,482	33,999
Korea	4,480	5,380	6,323	6,323	7,266	7,266	7,266	7,266
Philippines	—	—	—	—	—	—	—	—
Taiwan	4,924	4,924	4,924	4,924	4,924	4,924	4,924	4,924
Subtotal Far East	33,057	33,957	38,148	38,148	40,956	42,851	43,972	46,489
Other Nations:								
Argentina	935	935	935	935	935	935	935	935
Brazil	626	626	626	626	626	626	626	626
Canada	11,118	11,918	12,799	13,680	13,680	13,680	14,561	15,442
Egypt	—	—	—	—	—	—	—	—
India	1,244	1,244	1,244	1,244	1,244	1,464	1,464	1,684
Iran	—	—	—	—	—	—	—	—
Iraq	—	—	—	—	—	—	—	—
Israel	—	—	—	—	—	—	—	—
Libya	—	—	—	—	—	—	—	—
Mexico	—	—	—	—	—	654	1,308	1,308
Pakistan	125	125	125	125	125	125	125	125
South Africa	1,844	1,844	1,844	1,844	1,844	1,844	1,844	1,844
Turkey	—	—	—	—	—	—	—	—
Subtotal Other Nations	15,892	16,692	17,573	18,454	18,454	19,328	20,863	21,964
TOTAL WORLD[1]	229,724	245,139	263,281	273,088	284,483	288,467	295,815	301,370

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[1] Includes only those nations that participate in the commercial uranium market. Nations which are excluded are Bulgaria, Cuba, Czechoslovakia, Germany (GDR), Finland (two USSR-supplied plants), Hungary, Poland, Rumania, and the USSR.

TABLE 2B

NUCLEAR GENERATING CAPACITY FORECAST: 1994-2000

Reference Case
(Electrical Megawatts Net)

REGION	1994	1995	1996	1997	1998	1999	2000
United States	106,106	106,106	105,931	107,081	108,294	108,294	108,294
Europe							
Austria	—	—	—	—	—	—	—
Belgium	5,450	5,450	5,450	5,450	5,450	5,450	5,450
Finland (TVO only: excludes 2 units supplied by USSR)	1,426	1,426	1,426	1,426	1,426	1,426	1,426
France	62,488	62,488	63,938	65,208	67,878	69,278	69,278
Germany (FRG)	22,601	22,601	22,601	22,601	22,601	23,831	23,831
Italy	3,289	3,289	3,289	3,289	4,264	5,089	4,829
Netherlands	500	500	500	500	500	500	500
Portugal	—	—	—	—	—	—	—
Spain	7,616	7,616	8,591	8,591	9,566	9,566	10,563
Sweden	9,493	9,493	9,493	9,493	9,493	9,493	9,493
Switzerland	2,925	2,925	2,925	2,925	3,850	3,850	3,850
United Kingdom	13,058	13,008	14,108	13,832	13,532	13,212	12,437
Yugoslavia	615	615	615	615	1,615	1,615	1,615
Subtotal Europe	129,461	129,411	132,936	133,930	140,175	143,310	143,272
Far East:							
China (PRC)	300	300	300	1,200	2,100	2,100	2,100
Japan	35,120	37,566	39,395	40,440	42,782	45,917	47,271
Korea	7,266	7,266	7,266	8,209	9,152	10,095	11,038
Philippines	—	—	—	—	—	—	—
Taiwan	4,924	4,924	4,924	4,924	5,824	7,674	8,624
Subtotal Far East	47,610	50,056	51,885	54,773	59,858	65,786	69,033
Other Nations:							
Argentina	935	1,627	1,627	1,627	1,627	1,627	1,627
Brazil	1,871	1,871	3,116	3,116	3,116	3,116	3,116
Canada	15,442	15,442	15,442	15,442	15,442	15,442	16,342
Egypt	—	—	—	—	—	—	—
India	1,684	1,904	1,904	2,124	1,724	1,724	1,724
Iran	—	—	—	—	—	—	—
Iraq	—	—	—	—	—	—	—
Israel	—	—	—	—	—	—	—
Libya	—	—	—	—	—	—	—
Mexico	1,308	1,308	1,308	1,308	1,308	1,308	1,308
Pakistan	125	125	125	125	125	125	125
South Africa	1,844	1,844	1,844	1,844	1,844	1,844	1,844
Turkey	—	—	—	629	629	629	1,229
Subtotal Other Nations	23,209	24,121	25,366	26,215	25,815	25,815	27,315
TOTAL WORLD[1]	306,386	309,694	316,118	321,999	334,142	343,205	347,914

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[1] Includes only those nations that participate in the commercial uranium market. Nations which are excluded are Bulgaria, Cuba, Czechoslovakia, Germany (GDR), Finland (two USSR-supplied plants), Hungary, Poland, Rumania, and the USSR.

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result of deferrals that were forced when the government announced its national energy plan in 1984.

Italy

Italy is heavily dependent on imported oil and needs alternate sources of energy, including a much stronger nuclear power program to help it diversify its electricity sources. After much ambitious planning, the Italian nuclear program has been at a standstill; only three units are in operation. However, in late 1985, Italy's state utility, Ente Nazionale per l'Energia Elettrica (ENEL), took the first positive step in twelve years toward the expansion of its installed capacity when it signed a contract with Ansaldo Meccanico Nucleare SpA, an Italian reactor supplier, to build two PWRs at the Trino Vercellese site. ENEL last ordered a reactor in 1973, when it contracted for the two Montalto di Castro BWRs. Italy's current installed nuclear capacity amounts to approximately 1.3 GWe, but is projected to grow to 4.8 GWe by the year 2000. However, in the aftermath of the Chernobyl accident, Italy's parliament called a National Conference on Energy for this fall, and ENEL is likely to substitute coal for any further nuclear expansion. For example, siting procedures and construction plans for proposed reactors in Lombardy and Puglia will likely be suspended, at least until the outcome of the conference.

Sweden

The final two units of Sweden's nuclear construction program entered commercial operation in 1985. With those additions, nuclear power provides approximately 50 percent of Sweden's electricity. Current installed capacity amounts to 9.4 GWe. However, Swedish law requires the development, in the 1990s, of a schedule which will provide for the decommissioning of all 12 plants by 2010. Nuexco had expected that future political developments in Sweden would repeal, or at least delay, the 2010 deadline. However, the country's reaction to the Chernobyl disaster has practically eliminated that possibility for the foreseeable future.

Belgium

Belgium has the second lowest electrical rates in the European Community, and France is the only European nation more dependent on nuclear power than Belgium. This current phase of 5.4 GWe installed capacity accounts for 80 percent of Belgium's electricity production. In addition, Belgium has financial interests in nuclear projects in Germany (Kalkar) and France (Chooz and Superphenix). During 1985, the final two units of its current program began commercial operation. Although planning may be underway for a possible fifth unit at the Doel site, at present Nuexco expects no new reactor orders for Belgium during the period of this study.

Switzerland

Switzerland's increasing difficulty in expanding hydropower utilization will place added pressure on a nuclear power program that may be losing public support, especially after Chernobyl. While the Swiss generally have been in favor of nuclear power, building a successful program that accounts for about 45 percent of the nation's electricity, the marginally pro-nuclear results of a 1984 referendum and fierce local opposition have reduced the likelihood that the next planned unit, Kaiseraugst, will be built. Five units are currently in operation, producing about 2.9 GWe; operation dates are indefinite for the planned Kaiseraugst and Graben units.

The Netherlands

Two units, totaling 500 MWe, are in operation in the Netherlands. Public opposition to an increase in the Dutch nuclear program has intensified since Chernobyl, but the possibility remains that the government will order another unit in the 1990s. Nuexco expects no increase in nuclear generating capacity through 2000.

Austria

It now appears certain that the completed Zwentendorf reactor will never be allowed to operate. Public opinion toward nuclear power, never favorable in Austria, worsened substantially following Chernobyl, making it politically unfeasible that the nuclear option will be exploited, at least for the rest of this century.

The Far East

The growing industrial and manufacturing sector in the Far East requires major commitments to electricity production. Traditionally, the Far East has been heavily dependent on imported oil. Indigenous coal resources are scarce, so these countries must import coal as well. Nuclear power is, therefore, important in these countries; its adoption has been accelerated partly in response to load growth and partly to replace oil-fired plants.

Japan

During 1985, four units entered commercial operation, increasing installed nuclear capacity to 23 GWe. One unit was scheduled to begin commercial operation in 1986, Kyushu Electric Power Company's 846-MWe Sendai Unit 2, and it did so in the first half of this year. By the year 2000, Nuexco forecasts an installed nuclear generating capacity of approximately 52 GWe, a compound growth rate of over 5.6 percent per year. These figures are, however, somewhat more conservative than those established by the Ministry of International Trade and Industry (MITI) in 1984 and confirmed in 1985. MITI's forecast of installed nuclear capacity reaches 62 GWe in the year 2000. Nuexco's forecast is lower due to our somewhat more pessimistic

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assessment of siting constraints, licensing constraints and load growth projections.

Korea

Korea has brought two nuclear units into commercial operation during 1986, and now has six commercial nuclear units, comprising a total net generating capacity of 4.5 GWe. Korea Electric Power Company will complete a seventh unit, Korea Nuclear Unit 8, during 1987. Two other units already in advanced stages of construction will be completed this decade, bids have been invited on two more units scheduled to be operating by 1998, and Nuexco also projects orders for two to seven more units. If four of those units enter commercial service by the year 2000 as projected, they will increase Korea's installed nuclear capacity to 11 GWe. Even if those expectations are not all met, Korea will still maintain a strong nuclear power construction program throughout the remainder of this century.

People's Republic of China (PRC)

The PRC continues to pursue plans for an ambitious nuclear program, although officials recently scaled back plans calling for 10,000 MWe of nuclear generation by the year 2000. The current plan calls for 6,000 MWe by 2000, utilizing a combination of 300 MWe, 600 MWe, and 900 MWe units. Plans for two units at Sunan have been postponed indefinitely. Nuexco expects the 300-MWe Qinshan unit, currently under construction, to enter commercial operation in the early 1990s. The two 900-MWe Daya Bay (Guangdong) units are expected to enter service in the late 1990s. Thus, Nuexco forecasts approximately 2.1 GWe to be operational at the end of the study period.

The Philippines

The status of the Philippines' 620-MWe PWR is officially categorized as indefinite, but strong opposition to the plant's operation, including that of President Corazon Aquino, will almost certainly prevent its operation.

Taiwan

For Taiwan, the latest addition marks the end of the present program, principally due to the effects of lower-than-expected economic growth. However, due to expected increases in electricity consumption and economic growth in the 1990s, Nuexco projects a resumption in ordering and the addition of three new plants between 1996 and 2000 for a total installed capacity of 8.6 GWe by the end of the period.

The United States

Financial constraints, diminishing load growth, licensing problems, and meager public support continue to plague the US nuclear industry. Nevertheless, there have been signs in the last few years that indicate a recovery from the problems of the post-Three Mile Island period. Foremost among them is the fact that no units were canceled in 1985, an event that last occurred in 1973. Yet it is almost certain that no new units will be ordered before 2000, mainly due to financial and licensing constraints. Thus, all nuclear capacity additions through the year 2000 will come from plants currently under construction. Moreover, after considering the long construction cycles commonplace in the USA, it is virtually certain that plants not yet under construction in the USA will not be able to begin commercial operation during this century.

US installed capacity of 74 GWe at the beginning of 1986 has already been augmented by three units having a combined capacity of 3.4 GWe; four other units should enter commercial operations, raising the US installed nuclear capacity to 82.3 GWe, by the end of this year. Further additions to capacity will raise the US total to 105.1 GWe by the end of 1990; that figure will be approximately 37 percent of the world total. However, increases in the next decade will be only 3.2 net GWe, so the US portion of the world's installed nuclear capacity will decline to only 31 percent. After that time, decommissionings will begin to reduce US capacity unless other nuclear units are brought into service. Technical improvements could extend plant lifetimes, but that would only postpone for a few years the effect of decommissioning.

There is a possibility of resuming construction on some of the canceled or indefinitely delayed (but partially completed) nuclear power plants. If the obstacles to such resumptions of construction could be overcome, the units might be completed promptly. However, utility experience with these plants has usually been financially disastrous, publicity has been negative, quality assurance programs are incomplete and retrofit programs would be required to upgrade the technology. In general, Nuexco has discounted the likelihood that construction on any of those deferred units will resume. However, one notable exception is apparent. Philadelphia Electric Company has resumed construction on Limerick Unit 2, now scheduled for completion in 1991.

In establishing our forecast of dates for commercial operation, Nuexco generally used data pertaining to individual operating entities and individual power plants, rather than applying nominal figures over an entire region or reactor type. In a few cases in the USA, however, where adequate information specific to an individual case was not available, Nuexco used a nominal construction schedule. In that event, the units were placed on a 7-year construction cycle (in a so-called S-curve) which relates plant status to year of commercial operation as follows:

ANALYSIS & COMMENTARY

Time to Commercial Operation of Nuclear Plants Under Seven-Year Construction Schedule

Plant Status	Current Construction Completion (%)	Year of Commercial Operation
Under Construction	100	1986
" "	90 to 99	1987
" "	75 to 89	1988
" "	55 to 74	1989
" "	30 to 54	1990
" "	15 to 29	1991
" "	7 to 14	1992
" "	0 to 6	1993

This schedule may be slower by up to four years than the scheduled completion dates announced by the respective utilities. Nevertheless, it is an ambitious schedule when compared to past results in the USA.

Although the current outlook for longer-term growth of nuclear power in the USA is poor, 1985 proved to be a relatively encouraging year. No nuclear plants were canceled during the year, whereas eight units were canceled in 1984. Some might consider 1985 as a transition year for nuclear power. However, even though the Chernobyl accident will adversely affect only a few US units in the near term, it will postpone even further any resurgence of US public acceptance of nuclear power in the long term.

Other Nations

The *Other* category has been changed from previous editions of the market study. The North American region has been replaced by the USA, and Canada and Mexico are now included among the *Other Nations* category. Nuclear power growth in these countries will continue to be gradual. Nuexco forecasts that an installed nuclear capacity of 14.6 GWe at the beginning of 1986 (15.9 GWe by the end of 1986) will grow at an annual compound rate of 4.2 percent, to 27 GWe in the year 2000.

Countries in this category, other than Canada, have electrical demands and distribution systems that are not well suited for today's large commercial designs. While some reactor vendors are looking at smaller designs (300 MWe) for such applications, several factors continue to deter the development of nuclear programs, including:

— the complexity of current nuclear power plant designs;
— the difficulty of financing relatively large projects;
— the need for trained operating staff.

Canada is approaching the completion of its current phase of nuclear power deployment. Two units have entered commercial operation in 1986, bringing the nation's total installed capacity to 11.1 GWe. Five other units now under construction will probably enter operation by the end of 1993, raising the nation's nuclear capacity to 15.4 GWe. One projected future order could enter commercial operation during the year 2000, raising the total to 16.3 GWe.

The prospect of exporting power to the northern USA has been a significant factor in the growth rate of the Canadian nuclear program. However, prospects for such exports have declined of late, as load growth projections have been reduced in the USA. As a result, waning interest on the part of US utilities in the northeast that had been expected to invest in Point Lepreau Unit 2 has made the unit's construction uncertain. Absent any investment on the part of US utilities, it is doubtful the unit will be built during the study period. In addition, declining electricity demand and rising construction costs probably will continue to hinder new plant orders and construction in Canada.

India placed one unit into commercial operation in 1985. While installed nuclear capacity is expected to remain small, India's program probably will continue to develop steadily as four units now under construction, each 220 MWe, come into operation in the 1990's. *Argentina, Brazil, Mexico* and *Turkey* (which is projected to have two units in operation late in the 1990s), all have small, very slowly developing nuclear power programs that are limited primarily by the nation's ability to finance or obtain financing for nuclear plant construction.

Two countries in this category, *Pakistan* and *South Africa*, have some installed nuclear capacity, but are not expected to add more capacity during the period of the study. *Egypt, Iran, Iraq, Israel* and *Libya* all have considered initiating nuclear power programs, but none are expected to begin any commercial construction operations during the period. However, these countries are included in the tabular data.

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THE SPOT MARKET AND THE SPOT PRICE: APPLICABILITY AND LIMITATIONS

by
George White, Jr.
Managing Broker, Nuexco

The following slightly edited presentation was given by George White, Jr., Managing Broker of Nuexco, at the Uranium Institute's Eleventh Annual Symposium in London, September 4, 1986.

The general subject of spot prices and their relationship, if any, to long-term contracts raises numerous issues. Today I would like to address the latter, which I believe to be the more important of those issues. To provide a framework for what follows, I need to share a bit of history with you. The original name of our company was to be Nuclear Bank Corporation. We found, however, that the use of the word "Bank" in the corporate name made us subject to certain US laws regulating the banking industry. The name was quickly changed to Nuclear Exchange Corporation, and we promptly began to refer to ourselves as Nuexco, and the name was officially changed to Nuexco in 1977.

I am often asked "Where in the world did you come up with the term Exchange Value? Why not Spot Price or Spot Value?" Recall the company name was Nuclear *Exchange* Corporation. We were a new company and proud of the name. And, as some of you may recall, Nuexco was organized to engage in the business of arranging uranium loans. The idea was simple and akin to the banking business. Those who had too much uranium could deposit their excess in Nuexco's "bank." Those who had short-term needs could borrow from this uranium "bank," paying interest to the depositor whose uranium was borrowed and a small fee to Nuexco for its services in arranging the loan. Naturally, the borrower had to replace the uranium it had borrowed. Since it was unlikely that the borrower could repay the *exact* number of pounds borrowed, Nuexco published a value that was intended for use in settling the loan when the quantity of uranium repaid was slightly more or slightly less than the quantity borrowed.

At that time, Nuexco's value was the only immediate price indicator available. In all markets, buyers and sellers look for reference points to assure themselves they are not paying too much or receiving too little, so as to justify the prudency of their actions. In time, some uranium buyers and seller began to use the Exchange Value to price spot market uranium transactions. Eventually, the Exchange Value came to be used in longer-term contracts, usually as a base price which was subject to escalation for deliveries in later years. Still later, long-term delivery prices were simply defined as functions of the Exchange Value, in some cases subject to floor or ceiling prices.

We at Nuexco were somewhat surprised by these developments. In fact, we were flattered by what had been achieved, albeit more by accident than design. We also became increasingly sensitive to the responsibility thus acquired. Procedures and record keeping grew more formalized. Credibility became a matter of the greatest concern. Consequently, *nothing* that Nuexco does in its business is viewed more seriously than establishing those monthly values.

Some interesting things happened to Nuexco during those years. To our dismay, we found ourselves involved in just about every instance of uranium litigation, and we had the dubious pleasure of spending days in front of the federal grand jury conducting the 1976 antitrust investigation of the uranium industry. As spot prices surpassed the US$40 level in the latter half of the 1970s, some utilities became concerned that Nuexco was a "tool" of the uranium production industry. It was suggested that a less subjective, less judgmental measure of spot prices was required. In 1978, at this meeting, I announced the publication of a new price series, the Transaction Value, which we still publish. However, during the period 1975 to 1980, I do not recall any uranium producer ever expressing the *slightest* concern about the influence of the Exchange Value on long-term contracting. Quite the contrary, they were delighted and were quick to point out the validity and credibility of the Exchange Value.

But, as might be expected, spot prices started to decline and the uranium producers suddenly became concerned that Nuexco was a "tool" of the utility industry. That illustrates an important question — what exactly is the Exchange Value? The straightforward answer is that the Exchange Value is simply as it is defined. An easier answer is that the Exchange Value is merely an indicator of the level of spot market prices. However, an opposite approach notes what the Exchange Value definitely is not. Specifically:

— It does *not*, in any way, measure, indicate, or provide any information about uranium production costs nor, by extension, about the prices at which future supplies of uranium should be sold in order to justify investment in new production facilities.

— It provides *no* information with respect to prices being paid for uranium that is being delivered today under contracts entered into at earlier dates.

— It provides *no* information nor judgment about correct, appropriate, economic, or fair prices for uranium.

In the past, Nuexco has gone to considerable lengths in our Monthly Report, special reports, and numerous papers to make these points clear. As spot uranium prices rose rapidly during the mid and late 1970s, a great deal of uranium was sold under

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COMMENTARY

contracts with base-escalated or spot market related pricing provisions. Often the base price was at or near the level of spot prices as of the date the contract was signed. These contracts were particularly prevalent in the United States. Base prices of US$30.00 to $40.00 per pound U_3O_8 were commonplace. With the high inflation experienced during those years, the escalation factors drove actual delivery prices rapidly upwards to US$60.00 to $70.00 per pound, and in some cases even higher. Of course, the bulk of these deliveries were made just as spot prices declined. The comparison between a current delivery price of US$60.00 per pound U_3O_8 under a long-term contract and the current spot price level of about US$17.00 is dramatic and a source of considerable embarrassment for the utilities involved.

The response of many utilities, particularly in the USA, was to get out of those contracts as fast as possible. Some negotiated terminations with their suppliers; others went to court, filing lawsuits to break the contracts. Many adopted policies against entering contracts, the pricing provisions of which could operate so as to cause them to pay more than spot market prices for uranium. The driving force for most US utilities was and continues to be Public Utility Commission criticism and the threat of being unable to recover, through rate adjustments, uranium costs that are in excess of spot-market prices.

Historically, non-US utilities have been less concerned about possible divergences between spot prices and those being paid under long-term contracts. The primary reason is that, lacking domestic uranium production capability, they and their regulators are relatively less sensitive to short-term pricing trends and more sensitive to long-term supplier relationships and the associated security of supply considerations. However, there are notable exceptions to this general rule. Some non-US utilities now face the unwelcome prospect of taking delivery of uranium under long-term contracts at prices well in excess of current spot price levels and then being required to mark it down to spot-market levels, producing immediate accounting losses.

Indeed, the decline in spot-market prices has affected the entire uranium industry. Despite assertions that they operate in an environment that is independent of the spot market, it has affected those producers that have historically negotiated prices on a year by year basis. It has affected those attempting to win supply contracts to base load new production facilities. It has altered the procurement philosophy of a number of utilities. Even if Nuexco and Nukem ceased publishing their values today, the situation would not change. Someone else would begin to publish price indicators tomorrow.

Much has been said and written about disassociating spot prices from long-term contracts, but little has been accomplished. The idea of a broadly accepted, fair market price for deliveries under long-term contracts remains an illusion, despite its appeal. Despite the fact that is has been contemplated in many contracts, no such price exists today. In my judgment, is it not likely to exist in the future. In fact, I believe that the uranium market is moving in exactly the opposite direction — towards stronger links between spot prices and long-term contracts. Uranium is in the process of becoming a commodity, and spot market-based, commodity-type pricing will become the norm.

In support of this contention I note the following:

— First, while US utilities have historically been and remain the most insistent on spot-market-related pricing features in long-term contracts, it is evident, based on recent requests for proposals, that utilities in other countries are showing increased interest in such provisions.

— Second, an analysis of uranium pricing presented by Nuexco's Jim Vaughan at the Atomic Industrial Forum's Fuel Meeting in March 1985 indicated that, during 1983, 18 percent of uranium deliveries were at spot-market-related prices. For 1984 deliveries, the figure was 21 percent. We have since updated that analysis, and the figure for 1985 increased to slightly more than 28 percent. Moreover, the figures for all three years would have been higher by 10 to 13 percentage points had we included those deliveries that would have been made at spot-market-related prices *except* for the operation of floor-price provisions. Thus, in 1985 more than *40 percent* of all uranium effectively was delivered under spot-market-related contracts. While three years of data do not constitute a proof, a definite trend has become evident. In addition, the increasing percentages are impressive, particularly when compared to the common misconception that only about 10 percent of uranium is traded at spot prices.

— Third, contrary to prevailing conventional attitudes, it is clear that uranium demand is price-elastic. In a paper presented here last year, Phillip Crowson pointed out the difference between elasticity of demand and elasticity of requirements. I believe that the difference is perhaps even greater than suggested by Mr. Crowson. Specifically, the existence of large inventories has increased the price elasticity of uranium demand. Consider the following points:

— As of the end of 1985, uranium inventories held by commercial entities exceeded 475 million pounds U_3O_8 equivalent.

— During the seven years 1979-1985, when prices were declining or low, production exceeded consumption in each and every year, and total additions to inventory exceeded 200 million pounds U_3O_8.

— The clearing of excess inventory overhang from the spot market began in 1979 and was confidently predicted by most observers to be a short-term affair that would run its course in a few years. That process is now in its eighth year.

— Finally, despite past and present forecasts of uranium

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production and consumption, we do not anticipate any significant reductions in the absolute size of inventories in the next decade. As Mr. Crowson also noted in his paper, those expressing concern about possible future shortages of uranium tend to ignore the behavior and motivations of mining companies which come under very strong pressure to exploit promising orebodies, regardless of the prevailing state of the market.

I am aware that this view of future uranium pricing provides little solace to some current and would-be uranium producers. Most observers would agree that in the longer term, and ignoring historically short-term fluctuations in exchange rates, a price of US$17.00 per pound U_3O_8 (in constant 1986 dollars) will not provide the requisite worldwide incentive for the development and exploitation of the reserves needed to meet longer-term uranium requirements. The problems and risks associated with pricing long-term delivery commitments at spot-market-related levels are well known and have been discussed in this and other forums at great length.

In actuality, however, an increasing number of buyers are insisting on spot-market-related pricing, and more uranium is being delivered at such prices, even though such prices may not bear any meaningful relationship to uranium production costs. The change has been gradual and is likely to continue as such. Moreover, to the extent that potential sellers are unwilling or unable to agree to such pricing terms, buyers will eventually seek sellers who will agree to those terms. Some buyers and sellers can be expected to resist strenuously and continue to price uranium with relatively less consideration to what is happening in the spot market. However, as their numbers decrease, and as ever increasing quantities are delivered at spot-market-related prices, theirs will be an increasingly difficult position to maintain.

In closing, I quote from Mr. Crowson's paper. Speaking of uranium in comparison with other metals and minerals, he notes:

> "Granted it does have many special, even unique, features, uranium is nowhere near as atypical as is often claimed. The similarities with minerals, including the other energy minerals, are much closer than is usually acknowledged..."

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RECENT DEVELOPMENTS

AUSTRALIA

In Report 216 (August 1986, page 23), Nuexco noted that at the National Labor Party Conference, the government had voted to continue its ban on uranium shipments to France until that country ceased testing nuclear weapons in the South Pacific region. Since 1984, that ban had directly affected shipments of uranium under a contract between Queensland Mines Ltd. and Electricite de France. In late August, however, the Australian government decided to abandon that policy as a consequence of increasing budgetary pressures and the recognition that the ban had had virtually no effect on French policy and stood no chance of altering that policy in the immediate future. The government estimated that its expenditures required to purchase the Queensland Mines uranium originally destined for EDF would have totaled A$66 million, including about A$25 million during this fiscal year. A resumption of deliveries would remove the need to expend the latter sum, and might make possible the recovery from EDF of those amounts expended in past years for the 800 metric tons U_3O_8 already purchased by the Australian government.

Since EDF holds large uranium supplies independent of the Australian deliveries, the only consequence of banning the Queensland Mines shipments has been to penalize Australia financially. While the announcement probably will cause some political embarassment for the Australian government, the timing of the decision was based on economic necessity, and the economic relief undoubtedly will be welcomed. The move could also have the ancillary benefit of opening France as a potential market for the Olympic Dam (Roxby Downs) material.

The following comments are excerpts from the press release issued on August 19, 1986 by the Minister for Energy and Resources:

"The government has decided, after carefully balancing all relevant considerations, to lift the embargo on exports of uranium to France which was introduced in 1983. This decision...was taken in the light of the need to explore every available avenue to achieve spending reductions and revenue returns. It has significantly limited the extent of cuts the government was forced to make in other areas, including welfare."

"The government will save A$25.4 million in 1986-1987 by not purchasing uranium from Queensland Mines, and will receive a further A$40.8 million through repurchase of uranium bought by the Commonwealth from QML last year as a result of the ban. Another A$0.2 million will come from the uranium export levy on this material. The lifting of the embargo will also produce longer-term benefits, with further budget savings...and from opening of the French market for further exports of Australian uranium for peaceful purposes."

"The embargo...has not pushed France towards ceasing nuclear weapons testing in the South Pacific. There was never any possibility of other uranium suppliers joining the Australian embargo against France, and no real prospect at any stage of France being economically hurt by our actions. The only impact of the embargo on France to date has been to relieve it of the obligation to take contracted Australian uranium at higher than spot-market prices."

* * *

Two exploration companies signed the first agreement with Aboriginal landowners for mineral exploration in the Northern Territory since the Aboriginal Land Rights Act was passed in 1976. Kumagai Gumi Company Ltd., a Japanese exploration and construction company, and Uranerz Australia Pty. Ltd., a subsidiary of the German uranium production company, have formed an equal-share joint venture for exploration in Australia. The agreement gives the joint venture partners the rights to mine on a 65-square kilometer area of West Arnhem land in the Northern Territory. The area is near the Nabarlek uranium mine, and is believed to contain substantial reserves of uranium, gold, platinum, and tin.

Over 150 companies had been competing for the rights to exploit the area. The Northern Land Council negotiated the agreement, and following the announcement emphasized that Aboriginal landowners were not averse to mineral development on their land provided their concerns are taken into consideration. Both of the companies involved in the joint venture appear to be interested in the area in order to diversify their sources of supply. However, the precise mining terms of a given ore deposit will probably not be negotiated until exploration results are known. Moreover, until the political climate of the Northern Territory and the federal government become more receptive to uranium mining and sale, the partners are not likely to realize any short-term commerical benefit from the agreement.

UNITED STATES

Introduction

Several legislative proposals currently under review in the US Congress could strongly affect the international nuclear fuel market in the coming months. The following summary examines the present status of these measures, some of which concern US trade with South Africa, and others that deal with the viability of the US uranium production sector or DOE's attempts to impose new criteria governing its enrichment program. It is important to note that each of these measures is subject to review by various committees in the Senate and House of Representatives, so the details of any particular piece of legislation can undergo major revisions, sometimes in a matter of days.

South African Uranium

On the strength of public pressure to impose stricter sanctions against South Africa's government because of its apartheid policies, several bills designed to restrict trade between the USA and South Africa have been introduced in Congress over the last few years. In September 1985, President Reagan avoided signing a bill that would have brought trade restrictions against South Africa, choosing instead to issue an executive order that accomplished some of the same goals but imposed less harsh measures. Over the last few months, however, new concern has developed following the South African government's recent reimposition of a state of emergency. In May 1986, Senator Edward Kennedy (D, Massachussetts) proposed the Anti-Apartheid Act of 1986 (S. 2498), which was never brought to the floor of the Senate. Among other restrictions, the bill would have banned the importation of uranium, coal, and steel from South Africa. Two months later, elements of the Kennedy bill were incorporated into Senator Richard Lugar's (D, Indiana) legislation (S. 2701), which was referred to the Committee on Foreign Relations. Shortly thereafter, the Lugar bill was passed by the Senate, and must be passed by the House of Representatives and signed by the President before it can become law. The bill also contains language that would ban the importation of uranium, as follows:

> "Sec. 311(a) Notwithstanding any other provision of law, no uranium ore, uranium oxide, or coal that is produced or manufactured in South Africa may be imported into the United States. This section shall take effect 90 days after the date of the enactment of this Act."

Importantly, there are no provisions stated in this act which provide for the grandfathering of existing contracts, although there appear to be no restrictions on any South African origin uranium presently in the USA. Moreover, the language bluntly prohibits *any* importation of South African uranium ore or oxide, regardless of whether it is intended for use in the USA or will only be converted or enriched in the USA. Thus, if the bill becomes law, non-US utilities would be unable to enrich South African uranium (that is not already in the USA) at DOE's enrichment facilities. At present, it is unclear how the proposed law would treat the UF_6 resulting from conversion of South African U_3O_8 at a non-US converter.

Concurrently, members of the House of Representatives were drafting legislative sanctions against the South African government. H.R. 4868 was introduced in May by Representative William Gray (D, Pennsylvania) and 30 cosponsors. It was subsequently referred to the Committees on Foreign Affairs; Ways and Means; and Banking, Finance and Urban Affairs. The House was expected to pass the bill, but instead it approved a stricter substitute bill proposed by Representative Ronald Dellums (D, California). Far more stringent than the Senate bill, this legislation effectively would ban all trade with South Africa as well as US investment in the country. The bill would take effect 180 days after being passed into law. The ban would extend to the importation of uranium ore and uranium oxide using the following language:

> "Notwithstanding any other provision of law, no article which is the growth, produce, or manufacture of South Africa may be imported into the United States, except for those strategic minerals of which…the quantities essential for military uses exceed reasonably secure domestic supplies…

It is unlikely that US uranium would be deemed so scarce that it could not adequately supply US military needs. Rather, such minerals as chromium and manganese, which are used in the production of aircraft and other military hardware, are more likely to fall into that category because of their scarcity outside of South Africa. Therefore, it is reasonable to conclude that uranium imports would be prohibited by the embargo terms specified in the bill.

The sanctions package presented by the House is so radical that if passed by the Senate, it would almost certainly be vetoed by President Reagan. The Senate bill, however, seems to have wider support within the Congress. For example, some observers noted that many conservative Republicans in the House of Representatives may have voted for the harsher House bill only because they felt certain it would not become law. Because similar bills were passed by both houses of Congress, it will be up to a conference committee to decide the form of a compromise bill to be presented to Reagan for his signature.

Although President Reagan continues to express his opposition to sanctions, the strong sentiment in Congress may be sufficient to override or even forestall a veto. However, Reagan might be able to circumvent the issue by vetoing the compromise bill presented to him while concurrently issuing an executive order containing some punitive action against South Africa. In this manner, any pressure on South Africa could be tailored to the philosophy of the Administration, while perhaps appeasing enough members of Congress to assure that his veto of the harsher compromise bill would be sustained. This was essentially the process that occurred in September 1985, when Reagan's executive order, among other things, prohibited shipments of nuclear equipment or technology until South Africa agreed to the terms of the Nuclear Nonproliferation Treaty.*

Domenici Legislation

The Uranium Revitalization and Tailings Reclamation Act of 1986, first introduced into Congress in April by Senator Pete

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*In actuality, such exports are already forbidden by US law, by virtue of the fact that South Africa has not signed the Nuclear Nonproliferation Treaty.

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Domenici (R, New Mexico), is currently undergoing revision. The terms of the bill as it appeared in April are examined in detail in Report 215 (July 1986, page 5). Its major points are the imposition of a 50-percent embargo on US utilities' use of foreign-origin uranium; the write-down of DOE's enrichment debt to only $350 million through FY1986; the approval of DOE's Utility Services Enrichment Contract; and the formation of the Uranium Mill Tailings Fund to subsidize the reclamation of mill tailings sites across the country.

Presently, the legislation resides in Senator McClure's Committee on Energy and Environment. The bill probably will be reintroduced to the full Senate when it returns from recess in September. At that time, the bill is likely to be published in its revised form in the *Federal Register*; until then, it is difficult to speculate on its latest provisions.

DOE's Proposed Enrichment Criteria

An article in Report 216 (August 1986, page 12) examined DOE's proposed criteria governing uranium enrichment, which were released (in draft form) for review and comment during the first half of 1986. In late July, when the final wording was established, the proposed criteria were submitted to Congress by DOE for the required 45-day review. Congress must enact legislation or adopt a joint resolution opposing the criteria within the 45-day period in order to prevent the proposed changes from taking effect. Absent action from Congress during the 45-day period, the proposed criteria would have acquired the force of law.

In early August, the US Senate passed a joint resolution prohibiting DOE from providing enrichment services under the terms of the proposed criteria. The resolution (Joint Resolution 668) was sponsored by Senator Domenici, and the bill to which it was attached is necessary to increase the statutory limit on the public debt. Thus the bill with the amendment disapproving the new criteria, although it must go back to the House of Representatives for review, will almost certainly pass. However, the House could strip the debt bill of any or all of its amendments, including the one pertaining to enrichment criteria, before it is forwarded to the President for his signature.

Shortly after the Senate amendment was passed, Representative Bill Richardson (D, New Mexico) and eight other sponsors introduced in the House a separate resolution disapproving the criteria. House Joint Resolution 699 was immediately referred to the Committees on Energy and Commerce and on Interior and Insular Affairs. A subcommittee of the former, the House Energy and Commerce Subcommittee on Energy, Conservation and Power (chaired by Rep. Edward Markey) acted favorably on the resolution. The resolution simply states:

> "Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, that the Secretary of Energy may not provide uranium enrichment services under the terms and conditions of the criteria that, on July 24, 1986, were submitted to Congress pursuant to section 161(v) of the Atomic Energy Act of 1954 (42 U.S.C. 2201 (v)) and, on July 29, 1986, were published in the Federal Register (51 Fed. Reg. 27132)."

Sponsoring Congressmen in the House and Senate gave similar reasons for the introduction of the resolutions. In particular, Senator Domenici argued that although DOE provided for a public comment period before the proposed criteria were submitted to Congress, "they clearly have not taken the comments seriously." He argued that DOE's estimate of its enrichment debt was far too high because it had assigned all of its investment and unrecovered costs to the commercial enrichment enterprise, and did not assign any costs to the defense program. Further, he maintained that if utilities are required to finance this debt through future prices paid to DOE for enrichment services, many utilities would contract elsewhere for enrichment, further jeopardizing DOE's cost recovery. Finally, he stated that the "policies embodied in (the new criteria) are directly detrimental to the (US uranium) mining industry because of the use of the federal stockpile and the low price that the Department will be placing on the stockpile uranium."

Ultimately, it is likely that one of the joint resolutions will be attached to a bill that is passed in both houses of Congress and signed by the President when Congress reconvenes in September. At present, the bill to increase the debt ceiling, with the Senate amendment attached, will probably pass within a relatively short time. At any rate, the rapid acceptance of both resolutions indicates that DOE's proposed criteria clearly do not have Congressional support. As it now stands, only a failure on the part of Congress to pass *some* virtually veto-proof legislation to accompany the disapproval amendment would allow the enactment of the proposed criteria. Currently, there are several bills pending that are almost certain to become law, any of which could serve as carriers of the disapproval amendment.

The strong Congressional opposition to the DOE maneuver could hurt DOE's chances in its appeal in the ongoing uranium producers' litigation before the Tenth Circuit in September. If Congress had ignored the submission of the proposed criteria, clearing the way for their acceptance, DOE could argue that its policies have the support of Congress. However, the US producers will almost certainly use the Congresssional opposition to argue that another powerful group is against DOE's current policies, a circumstance that is likely to have some influence on the appeal court's judgment as to whether DOE should be allowed to determine when enrichment limitations are necessary to support the US uranium production sector.

FUEL CYCLE FACILITIES IN JAPAN

Introduction

Japan's fuel cycle companies and utilities are proceeding with their plans to build uranium enrichment, low-level waste storage, and reprocessing facilities at a common site in Aomori Prefecture. Located on the northern end of Japan's main island of Honshu (Figure 2), the site will encompass some 6.5 million square meters (2.6 square miles), including greenbelt areas around the facilities. Investment in the three facilities is likely to exceed US$4 billion, promising industrial growth for a less developed region in Japan. Moreover, the facilities represent another step in Japan's inclination toward self-sufficiency in the nuclear fuel cycle.

FEPC Proposal

Plant siting, particularly for waste storage and reprocessing facilities, has been an obstacle to the completion of the nuclear fuel cycle in Japan. Most spent fuel is currently stored on-site, though a portion is shipped to France and the United Kingdom for reprocessing. In mid-1984, the Federation of Electric Power Companies (FEPC), Japan's utility coordinating organization, announced a plan for the siting of the domestic enrichment, reprocessing, and storage facilities. The plan specified the Mutsu-Ogawara area of Aomori Prefecture as the location. The FEPC issued the proposal, subject to local and national government approvals, and the response in the prefectural area was favorable.

An alternate proposal released at the same time recommended locating the enrichment and waste storage facilities in the Mutsu-Ogawara area and the reprocessing facility at Higashidori, 30 kilometers to the north. Local and national governments had designated the Mutsu-Ogawara site for industrial development prior to the FEPC proposal; Higashidori was already designated as a future nuclear power plant site. Following the announcement, the prefectural governor met with national government officials to solicit cooperation in the implementation of the plan. Subsequent discussion by FEPC representatives with local officials and citizens' groups of Aomori Prefecture resulted in the selection of the single site for the entire complex, near the municipality of Rokkasho-Mura in the Mutsu-Ogawara industrial development area.

Later in 1984, the FEPC modified and formalized some of the details surrounding the complex, including facility capacities and scheduled operation dates. Table 3 summarizes some of the details of the planned complex.

Table 3

SPECIFICATIONS OF JAPAN'S COMMERCIAL FUEL CYCLE FACILITIES

	Uranium Enrichment Plant	**Spent-Fuel Reprocessing Plant**	**Low-Level Waste Storage Plant**
Location	Oishitai Rokkasho-Mura	Iyasakatai Rokkasho-Mura	Oishitai Rokkasho-Mura
(Prefecture)	Aomori	Aomori	Aomori
Operating Company	JNFI	JNFS	JNFI
Scale	Phase 1 - 600,000 SWU/year Phase 2 - 900,000 SWU/year 1.5 million SWU/year	800 tons/year plus 3,000 tons of spent-fuel storage	200,000 m^3 (About one million 55-gal. drums)[1]
Area	About 3.0 square kilometers (including low-level waste storage area)	About 3.5 square kilometers	About 3.0 square kilometers (including enrichment facility)
Schedules			
Construction	Start in 1986	Start in 1986	Start in 1986
Operation	1991	1997	1991

[1] May be expanded to 600,000 cubic meters (about three million drums).

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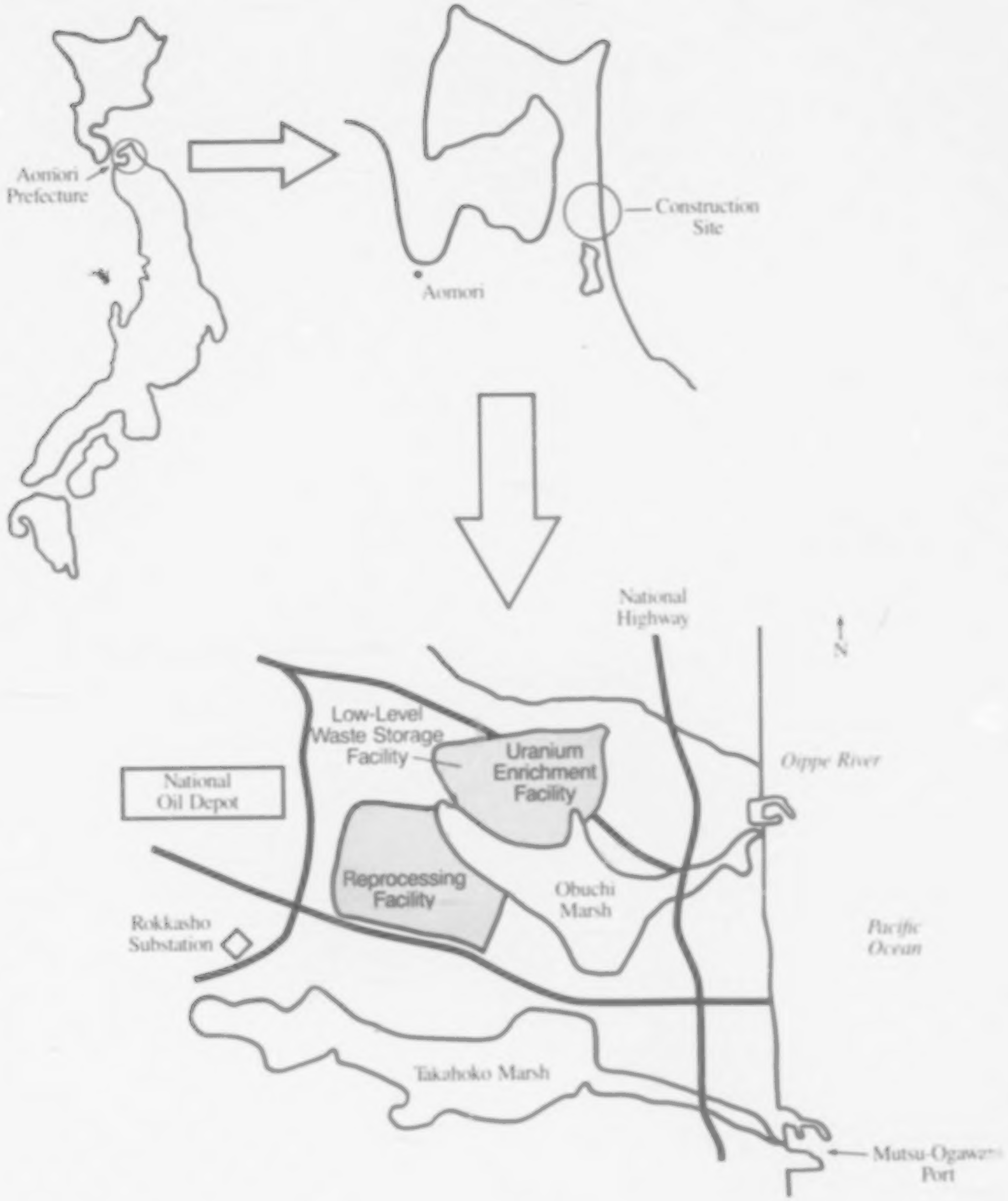
Aomori
Prefecture
Construction
Site
Aomori
National
Highway
N
Low-Level
Waste Storage
Facility
Uranium
Enrichment
Facility
National
Oil Depot
Oippe River
Reprocessing
Facility
Obuchi
Marsh
Rokkasho
Substation
Pacific
Ocean
Takahoko Marsh
Mutsu-Ogawara
Port

FIGURE 2. LAYOUT OF JAPAN'S FUEL CYCLE FACILITIES.

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Enrichment Plant

The Japanese utilities and other nuclear industry participants organized Japan Nuclear Fuel Industries (JNFI) in 1985 to own and operate a domestic enrichment plant with a capacity of 1.5 million SWU per year. Site environmental surveys and preliminary license preparations were initiated in early 1985, and the FEPC estimated that the plant will require an investment equivalent to approximately US$600 million. JNFI originally planned a progressive expansion of the enrichment facility, from an initial annual capacity of 150,000 SWU in 1991 to an annual capacity of 1.5 million SWU in 1997. The possibility of expansion to 3 million SWU per year in 2004 was also considered in the original plan. That figure would equal about one third of Japan's expected SWU requirements in 2004. Recently, however, JNFI and the utilities modified the plan, dividing it into two phases. Phase 1 will begin in 1988 with the construction of a 600,000 SWU per year plant. Although the exact schedule has not been determined, Phase 2 will add 900,000 SWU per year to the capacity, for a total of 1.5 million SWU per year capacity using centrifuge technology.

The facility's technology will be based on centrifuge technology developed by the Power Reactor and Nuclear Fuel Development Corporation (PNC). PNC is a quasi-government agency which developed the technology as a national project, primarily with government funding. Arrangements were completed to transfer the centrifuge technology from PNC to JNFI, but the commercial terms have not yet been announced. PNC began construction in November 1985 of a 200,000 SWU per year demonstration centrifuge enrichment facility on the western side of Honshu. The plant will act as a technology bridge between the PNC pilot plant (which confirmed PNC's technology) and the JNFI commercial-scale plant. Annual production of 100,000 SWU is scheduled for 1987 and full capacity of 200,000 SWU could be reached by 1988. In addition, PNC's demonstration plant output will serve the utilities' commercial power plants and is estimated to provide enrichment for two reloads annually.

Plant hardware for JNFI's commercial-scale facility will be supplied by Japan's three major nuclear manufacturers — Toshiba, Hitachi, and Mitsubishi Heavy Industries. These three companies participated as main subcontractors in PNC's previous enrichment development program. In 1985 their joint-venture manufacturing company, Uranium Enrichment Manufacturing Company (UEM), began construction of a new facility to produce centrifuge machines. Production is expected to begin in late 1986.

Although JFNI's initial plans called for a capacity of 3 million SWU per year at Rokkasho-Mura by 2004, several recent developments in the enrichment market influenced their facility planning. When the USDOE announced the cancellation of its gas centrifuge enrichment program (GCEP) in favor of existing diffusion technology as well as future laser technology, the Japanese utilities reevaluated their domestic programs and related economics, and considered the lower expected cost of enrichment using laser enrichment techniques. By the end of 1985, the utilities had decided to reduce the Rokkasho-Mura enrichment plant capacity to 1.5 million SWU per year using centrifuge technology, and to build a facility based on laser technology, possibly at a different location. The utilities, JNFI, and the Central Research Institute of the Electric Power Industry (CRIEPI) plan to conduct the joint development program. The group plans to spend approximately US$100 million over a five-year period, culminating in the operation of a laser enrichment facility with an annual capacity of 1,000 to 5,000 SWU. The start of the five-year period has not been scheduled, but the target date for commercialization of the project is the year 2000.

Reprocessing Plant

The Japanese utilities organized Japan Nuclear Fuel Services (JNFS) in 1980 to oversee the construction and operation of a commercial-scale reprocessing plant. The plant will consist of a reprocessing facility capable of processing 800 tons of spent fuel per year by 1995, and an adjacent 3,000-ton spent fuel storage facility, scheduled for operation in 1991. Most of Japan's spent fuel is stored by the utilities in pools at the nuclear plant sites, although some is being reprocessed via service contracts with European suppliers. The original reprocessing target of 1,000 tons per year in the early 1990s was modified several years ago. The estimated cost of the plant will be close to $3 billion.

The technology for the plant will be adopted from PNC's 210-ton per year demonstration plant at Tokai-Mura. PNC has operated the demonstration plant since 1977, based on European reprocessing technology, to serve as a basis for a domestic, commercial-scale facility. Although largely successful, the facility experienced numerous mechanical problems in its first several years of operation, processing less than 200 tons of spent fuel from domestic nuclear plants as of the end of 1983. Dissolver corrosion had caused the plant to be shut down in late 1983. In April 1985, PNC restarted the Tokai-Mura plant, reprocessing in excess of 70 tons of spent fuel from the Japanese utilities in the remainder of 1985. PNC planned to reprocess 140 tons of spent fuel during 1986.

The problems encountered by JNFS in finding a suitable location for a commercial-scale reprocessing plant were solved when the FEPC issued its proposal to locate all of the facilities at the Rokkasho-Mura site. As part of the joint siting, FEPC indicated JNFS would proceed with an initial spent-fuel storage facility capable of storing 3,000 tons of spent fuel by 1991. The

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facility would help to relieve some of the storage facilities at individual nuclear stations which have been accumulating increasing amounts of spent fuel. The 800-ton per year reprocessing plant is scheduled for completion in 1995, and provisions will allow for future expansion.

During 1985, JNFS proceeded with land-based environmental surveys and licensing activities for the reprocessing facility. It will introduce reprocessing technology which is based on that developed by the French company Fragema. JNFS also concluded basic negotiations whereby Mitsubishi Heavy Industries, with support from other nuclear manufacturers, would serve as the prime contractor for the new facilities. PNC will also have an advisory role in the reprocessing facility.

Low-Level Waste Storage

Part of the FEPC recommendation outlined a plan for the transport and storage of low-level waste generated by the nation's light-water reactors and other nuclear facilities. At present, each nuclear power plant has its own on-site storage for low-level wastes, such as contaminated equipment and clothing. By 1991, the national facility will have the capacity to store approximately one million 55-gallon drums. The original plan envisioned a possible expansion of the facility to allow for the storage of the equivalent of three million drums. The facility is expected to cost about $400 million.

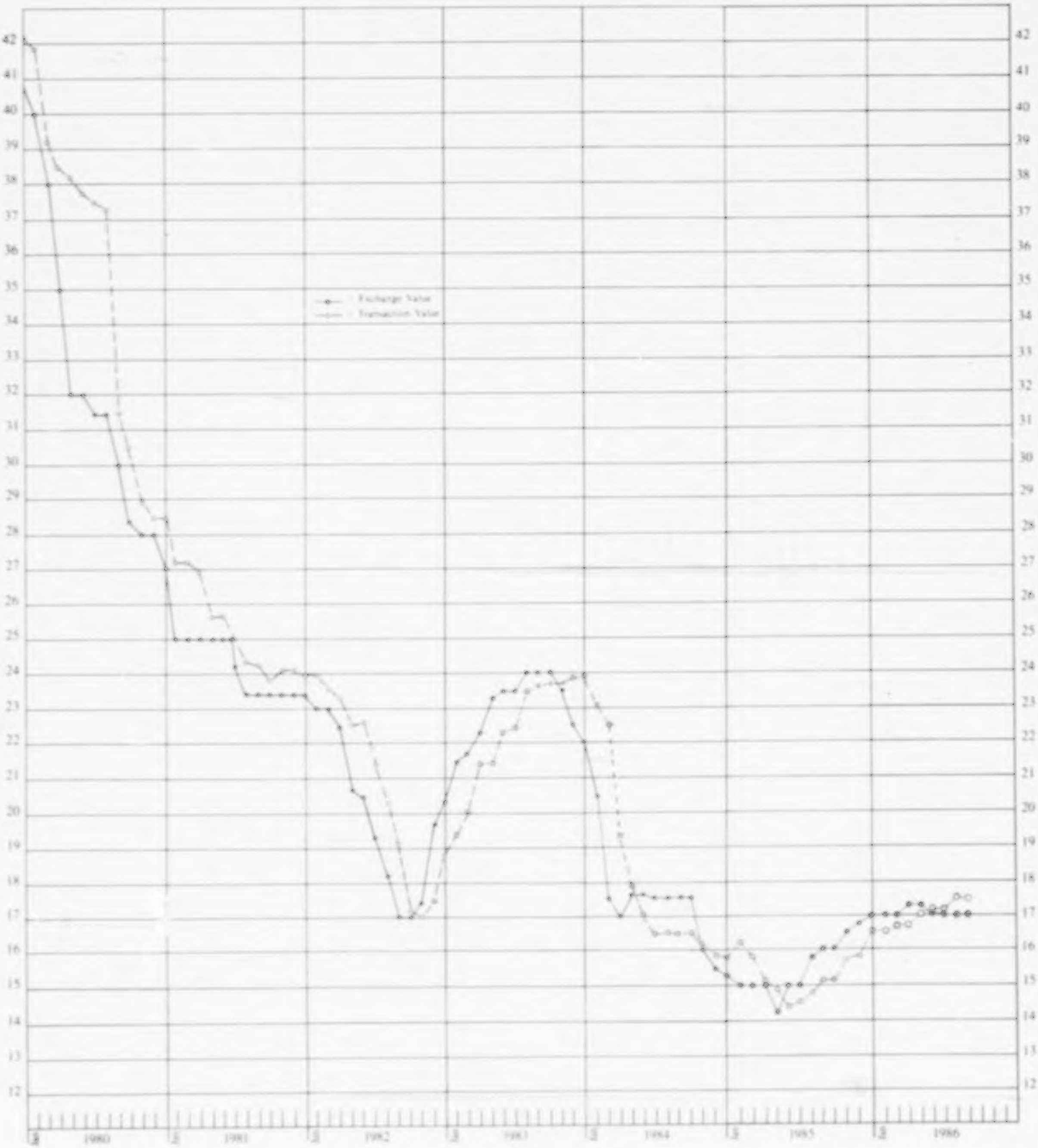
Latest Developments

In preparation for sea area environmental surveys for the entire complex, JNFS and JNFI needed to obtain agreements from five local fishing associations. Although four agreements were secured during 1985, the fifth was not received until March 1986. Immediately thereafter, surveys, which will examine marine life and phenomena in the sea and marshes around the site, were initiated. At present, the companies intend to maintain their schedules for operation of the enrichment facility, low-level waste storage, and spent-fuel storage pool in 1991, despite some delays in site investigation work during 1985. JNFS and JNFI recently completed negotiations with the Ogawara Development Company for the purchase of the land for the sites. The two companies purchased almost 750 hectares (1,875 acres) at a cost of approximately 72.5 billion yen (about $450 million).

The Japanese consortium for reprocessing, JNFS and Mitsubishi Heavy Industries, rejected an offer from Societe Generale des Techniques Nouvelles (SGN), a subsidiary of the French fuel cycle company Cogema, to transfer reprocessing technology to Japan for $90 million and some future royalties. Thus, the reprocessing plant at Rokkasho-Mura may experience an additional two-year delay, in which case the plant could be in operation in 1997.

EXCHANGE AND TRANSACTION VALUES SINCE JANUARY 1980

Determined as of the last day of the month indicated



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HISTORICAL MARKET DATA

HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	32.50	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	17.00	17.00	**17.00**				

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.15	17.20	17.50	**17.45**				

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U in UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.80	1.90	1.80	1.80	1.80	**1.90**				

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AUSTRALIA

	Price Index of Materials Used in Manufacturing Industry — All Groups[1] (1984 = 100)	**Award Rates of Pay Indexes Australia — Adult Males In Mining Wage Earners, Weekly Rates[2] (1976 = 100)**
1975 Avg.	150.4	132.6
1976 Avg.	168.4	160.9
1977 Avg.	192.0	179.0
1978 Avg.[3,4]	198.5	190.0
1979 Avg.	248.8	127.9
1980 Avg.	321.8	140.8
1981 Avg.	355.3	154.1
1982 Avg.[5]	368.6	174.9
1983 Avg.	401.6	181.8
FY84 Avg.[6]	95.3	—
FY85 Avg.[6]	100.0	—
Jan 1985	97.0	197.8
Feb 1985	98.6	197.8
Mar 1985	102.1	197.8
Apr 1985	104.4	202.8
May 1985	107.6	202.4
Jun 1985	108.7	202.4
Jul 1985	111.1	202.4
Aug 1985	110.5	202.4
Sep 1985	108.9	202.4
Oct 1985	108.7	202.4
Nov 1985	109.6	209.8
Dec 1985	110.2	209.9
Jan 1986	109.8	209.9
Feb 1986	108.9	209.9
Mar 1986	99.7	209.9
Apr 1986	94.5	209.9
May 1986	93.8P	209.9
Jun 1986	—	209.9

P = Preliminary R = Revised since last month

[1] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing In[illegible] Catalogue No. 6411.0). The basis of this index was revised to 1984 = 100. The previous index was 1969 = 100.

[2] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

[3] Monthly data for 1970-78 appear on pages 4.7 and 4.8 of Report 138.

[4] Annual averages prior to 1979 reflect index base no longer in use.

[5] Monthly data for 1979-82 appear on page 35 of Report 184.

[6] Annual averages are for financial year ending June 30.

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GOVERNMENT STATISTICS

CANADA

		Wage-earner Data: Average Hourly Earnings (C$)[2]					
	Industry Selling Price Index: All Commodities[1] (1981 = 100)	**Uranium Mines (SIC 057)**	**Metal Mines (SIC 051-059)**	**Mines, Quarries and Oil Wells[3] (SIC 051-099)**	**Primary Non-ferrous Metal Industries[4] (SIC 296)**	**(SIC 298)**	**Chemicals and Chemical Products[5] (SIC 372-379)**
1979 Avg.[6]	217.9	—	9.60	9.66	—	—	7.67
1980 Avg.	247.2	—	10.58	10.80	—	—	8.50
1981 Avg.	288.7	—	12.02	12.23	—	—	9.53
1982 Avg.[7]	288.8	—	13.74	13.92	—	—	10.63
1983 Avg.	298.8	—	—	14.30	—	—	11.17
1984 Avg.	310.9	17.88	—	15.07	12.28	10.49	11.76
Jan 1985	117.5	18.05	16.13	15.60	12.32	10.80	12.04
Feb 1985	117.7	18.78	16.41	15.68	12.52	11.05	12.06
Mar 1985	118.4	18.24	16.21	15.57	12.44	10.97	12.02
Apr 1985	118.3	18.63	16.44	15.80	12.81	11.23	12.04
May 1985	118.6	19.41	16.51	15.63	12.76	11.25	12.15
Jun 1985	118.6	18.49	16.20	15.49	12.89	11.14	12.14
Jul 1985	118.6	18.14	16.27	15.41	12.96	11.17	12.13
Aug 1985	118.4	17.07	16.03	15.30	12.97	11.31	12.19
Sep 1985	118.6	18.53	16.55	15.72	12.95	11.39	12.26
Oct 1985	119.0	18.74	16.51	15.70	13.14	11.53	12.33
Nov 1985	119.3	19.05	16.66	15.88	12.76	11.32	12.49
Dec 1985	120.0	19.07	16.57	16.01	12.51	11.09	12.59
Jan 1986	121.0	18.15	16.22	15.86	13.11	11.48	12.52
Feb 1986	129.9R	19.52	16.57	15.99	13.20	11.59	12.45
Mar 1986	120.3	19.04	16.65	15.93	13.11	11.59	12.54
Apr 1986	119.6R	19.38	16.68	15.95	13.07	11.64	12.54
May 1986	118.9R	19.54	16.68	15.78	13.16R	11.72	12.51R
Jun 1986	118.9	19.80P	16.63P	15.60P	13.04P	11.77P	12.42P

P = Preliminary R = Revised since last month

[1] Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Index prior to 1985, 1971 = 100.

[2] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours" (Catalogue 72-002).

[3] Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

[4] Beginning with the April 1983 figure, Primary Metal Industries, non-ferrous is split into SIC 296 and SIC 298.

[5] Chemical and Chemical Products prior to April 1983 was SIC 370-379. The new series is from a new survey which includes all companies and is based on a 1970 classification. The old survey only included companies of 20 employees or more.

[6] Monthly ISPI for 1977 and 1978 appear on page 4.10 of Report 138, and monthly wage-earner data for 1973-78 appear on page 4.11 of Report 138.

[7] Monthly data for 1979-1982 appear on page 37 of Report 184. On that page, the wage earner index entitled "Metal Mining, Including Milling (SIC 050-099)" should read "Total Mining (SIC 051-099)."

[8] Beginning with the March 1983 figure, Wage Earner Data are based on a census of all companies employing 200 or more wage earners, *plus* a random survey of companies employing fewer than 200 wage earners. Prior to March 1983 only companies employing 200 or more wage earners are included in the Wage Earner Data.

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REPUBLIC OF SOUTH AFRICA

		Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1]	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100)[2]	Consumer Price Index[3] (1980 = 100)[4]	Producer Price Index All Groups[5] (1980 = 100)	Total Employment in Mining and Quarrying (Code 35)[6]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[6]
1975	Avg.	16.71	—	157.2	100.0	639,473	1,003,617
1976	Avg.	19.30	—	174.7	115.1	671,240	1,212,983
1977	Avg.	23.87	—	194.4	130.0	712,006	1,420,670
1978	Avg.	27.14	—	137.2	142.7	664,571	1,537,169
1979	Avg.[7]	30.18	—	155.3	164.5	692,209	1,830,632
1980	Avg.[8]	35.53	—	176.7	192.1	714,379	2,279,615
1981	Avg.	41.89	—	206.5	218.3	728,506	2,820,505
1982	Avg.[9]	47.25	104.2	233.5	248.7	707,552	3,246,071
1983	Avg.	51.87	115.0	262.2	274.8	696,579	3,644,772
1984	Avg.	58.95	130.3	292.8	297.9	712,080	4,196,764
Jan	1985	—	—	177.1	166.6	711,366	376,777
Feb	1985	—	—	182.8	171.3	727,932	361,823
Mar	1985	64.48	142.4	183.6	173.0	708,809	371,380
Apr	1985	—	—	187.4	174.0	724,187	369,005
May	1985	—	—	189.5	177.7	708,085	373,478
Jun	1985	67.42	148.9	191.9	179.2	724,587	395,543
Jul	1985	—	—	193.6	180.7	738,228	419,106
Aug	1985	—	—	195.6	183.2	734,121	416,777
Sep	1985	70.47	155.3	197.8	184.8	732,836	419,883
Oct	1985	—	—	200.8	188.1	720,071	401,448
Nov	1985	—	—	203.4	196.0	750,049	432,996
Dec	1985	72.43	160.1	207.4	199.4	741,372	425,261
Jan	1986	—	—	213.8	203.6	744,070	449,513
Feb	1986	—	—	215.8	206.9	754,458	438,562
Mar	1986	75.76	167.8	218.3	206.9	759,897R	445,387R
Apr	1986	—	—	222.2	208.9	756,388	437,563
May	1986	—	—	222.6	212.5	754.788	425,544
Jun	1986	77.65	172.0	224.4	213.3	—	—
Jul	1986	—	—	228.8	—	—	—

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[1] Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly.

[2] Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

[3] Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."

[4] The basis for calculation prior to January 1985, 1975 = 100. For annual averages prior to 1978, April 1970 = 100.

[5] Previously known as the Wholesale Price Index, now the Producer Price Index. The computation remains the same. The basis for calculation prior to January 1985, 1975 = 100.

[6] Bulletin of Statistics, Department of Statistics, Pretoria.

[7] Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 4.9 of Report 140.

[8] Monthly data for Codes 35 and 40, 1977-1980, appear on page 28 of Report 157.

[9] Monthly data for 1979-82 appear on page 39 of Report 184.

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GOVERNMENT STATISTICS

UNITED STATES

	Producer Price Index[1]		Consumer Price Index[2]	GNP Implicit Price Deflator[3,4]	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[5]			
	Industrial Commodities (1967 = 100)	All Commodities (1967 = 100)	(1967 = 100)	(1982 = 100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980 Avg.[6]	274.8	268.8	246.8	178.64	10.26	10.63	8.30	6.94
1981 Avg.	304.1	293.4	272.4	195.51	11.55	11.98	9.12	7.62
1982 Avg.[7]	312.3	299.3	289.1	207.15	12.33	12.94	9.96	8.21
1983 Avg.	315.8	303.1	298.4	215.63	12.57	13.43	10.59	8.65
1984 Avg.	322.6	310.3	311.1	108.1	13.05	13.43	11.08	9.04
Jan 1985	322.9	309.5	316.1	—	13.29	13.70	11.39	9.33
Feb 1985	322.5	309.2	317.4	—	13.30	13.73	11.39	9.33
Mar 1985	322.6	308.7	318.8	110.4	13.29	13.95	11.37	9.39
Apr 1985	323.8	309.3	320.1	—	13.43	13.63	11.47	9.40
May 1985	325.3	309.8	321.3	—	13.24	13.60	11.44	9.39
Jun 1985	324.8	309.2	322.3	111.3	13.23	13.68	11.51	9.46
Jul 1985	324.4	309.0	322.8	—	13.45	13.83	11.59	9.47
Aug 1985	323.7	307.3	323.5	—	13.55	13.71	11.60	9.50
Sep 1985	322.3	305.5	324.5	112.1	13.44	13.68	11.65	9.54
Oct 1985	324.2	307.9	325.5	—	13.49	13.66	11.70	9.55
Nov 1985	324.7	309.5	326.6	—	13.49	13.97	11.80	9.61
Dec 1985	325.1	310.2	327.4	113.0	13.43	13.81	11.85	9.68
Jan 1986	323.8R	308.9	328.4	—	13.40	13.69	11.86	9.60
Feb 1986	318.9	304.4	327.5	—	13.44	13.82	11.81	9.60
Mar 1986	314.0	300.3	326.0	113.5	13.38	13.93	11.78	9.62
Apr 1986	311.3	297.9	325.3	—	13.54	13.87	11.82	9.62
May 1986	311.7	299.2	326.3	—	13.46R	13.79R	11.89R	9.64
Jun 1986	311.6	298.9	327.9	114.2R	13.52P	13.50P	11.95R	9.60R
Jul 1986	308.5	297.7	328.0	—	—	—	12.08P	9.61P

P = Preliminary R = Revised since last month

[1] US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

[2] US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items.

[3] US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

[4] The basis for calculation of this index was revised to 1982 = 100. 1984 and 1985 figures have been adjusted to that basis. The basis for calculation prior to 1984, 1972 = 100.

[5] US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for 1977-1978 are adjusted to the March 1979 benchmark. Data for January 1979 and beyond are adjusted to the March 1980 benchmark.

[6] Monthly data 1970-1978 for Producer Price Index-Industrial Commodities, Consumer Price Index, and Employment and Earnings SIC codes 10, 333, and 28, and quarterly data for GNP Implicit Price Deflator appear on pages 4.6-4.8 of Report 139.
Monthly data 1977-1978 for Employment and Earnings SIC Codes 10, 333, and 28 appear on page 33 of Report 147.
Monthly data 1970-1978 for Employment and Earnings SIC Code 36 appear on page 23 of Report 154.
Monthly data 1977-1980 for Producer Price Index-All Commodities, appear on page 21 of Nuexco Report 158.

[7] Monthly data 1979-1982 for all listed indices appear on page 41 of Report 184.

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NUEXCO

REPRESENTATIVES AND CONSULTANTS

JAPAN

Kazy Yokota

Japan Tech Services
Ohkura Building (3F)
1-4-10 Shiba Daimon
Minato-ku, Tokyo, Japan
Telephone: (81-3) 431-6031, 6025
Telecopy: (81-3) 434-6674
Telex: 242-5060 (JATECH J)

SOUTH AFRICA

Chris I. Von Christierson

Southern Prospecting (Pty) Limited
P.O. Box 61409
Marshalltown 2107
Republic of South Africa
Street Address:
10th Floor
Eagle Star House
70 Fox Street
Johannesburg 2001
Telephone: (27-11) 838-1868
(27-11) 834-4211
Telecopy: (27-11) 834-3148
Telex: 4-89878 SA

TAIWAN

Edward Bee

Bee & Liang Company, Ltd.
14 FL Universal Business Center
NO. 663, Tun Hwa South Road
P.O. Box 1396
Taipei, Taiwan R.O.C.
Telephone: (886-2) 704-9630
TWX: 785-11570 (BEELIANG)

UNITED STATES

Harold C. Lindberg

83-A Hardee Lane
Whispering Pines, N.C. 28327
Telephone: (919) 949-3622

SPECIAL CONSULTANTS

George J. Stathakis
International Investment Banking

James C. C. Stewart
U.K. Nuclear Industry

W. Bryan Webster
International Business Development

J. Robert Wolcott
International Business Development

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EXECUTIVE SUMMARY
REPORT 217
(All data as of August 31, 1986)

Exchange Value
$17.00, unchanged

The **Exchange Value** is **$17.00** per pound U_3O_8, unchanged since last month.

UF_6 Value
$48.00, down $0.25

The **UF_6 Value** is **$48.00** per kilogram U as UF_6, down $0.25 since last month.

Transactions

Five recent natural uranium sales are reported, involving approximately **1.5 million** pounds equivalent U_3O_8. All of the sales involved spot or near-term delivery, and four met the conditions for inclusion in the Transaction Value. Two of the transactions involved natural UF_6.

Supply-Demand Ratio
rose to 2.9:1

Active spot and near-term **uranium supply** amounts to **4.2 million** pounds U_3O_8 equivalent, up 355 thousand pounds since last month. Active spot and near-term **uranium demand** totals **1.5 million** pounds, down 1.2 million pounds. The spot and near-term **supply-demand ratio** rose to **2.9:1.**

Transaction Value
$17.45, down $0.05

The **Transaction Value** is **$17.45** per pound U_3O_8, down $0.05 since last month. The calculation includes 14 transactions involving a total of 2.6 million pounds U_3O_8 and equivalent UF_6, and covers a period of 3 months.

Loan Rate
unchanged at 4%

The **Loan Rate** is **4 percent** per annum, unchanged.

Conversion Value
$1.90, up $0.10

The **Conversion Value** is **$1.90** per pound U as UF_6, up $0.10 since last month. Active secondary market supply for conversion services for delivery within three years totals 1.3 million pounds U as UF_6. Active demand totals 1.0 million pounds U as UF_6. No secondary market conversion transactions are reported.

SWU Value for
delivery within
one year: $78

The **SWU Value** at .3 tails and for delivery within one year is **$78** per SWU, unchanged since last month. No secondary market SWU transactions are reported.

* * *

Analysis and Commentary

Nuexco forecasts indicate that installed nuclear power plant capacity in WOCA nations will grow from 230 GWe at the end of 1986 to 348 GWe by the end of the year 2000. This represents an annual growth rate of 2.8 percent, a figure slightly lower than the expected growth in electricity demand. This article is an example of the analysis used in Nuexco's Uranium Market Study and Price Forecast.

Commentary

The relationship of spot-market prices and spot-price indicators like the Nuexco Exchange Value to long-term contracting was the subject of a presentation given by George White, Jr. at the Uranium Institute's Eleventh Annual Symposium in London, England, September 4, 1986.

Australia

Increasing budgetary pressures have caused the Australian government to remove its ban on uranium shipments to France. Enacted in protest of France's nuclear weapons testing in the South Pacific, the ban was largely ineffectual, and the lifting of the ban relieves the Australian government from obligations to buy the Queensland Mines uranium destined for Electricite de France.

United States

Several legislative proposals currently under review in the US Congress could strongly affect the international nuclear fuel market in the coming months. Some of the bills concern US trade with South Africa, and others deal with the viability of the US uranium production sector or DOE's attempts to impose new criteria governing enrichment.

Update

Japan's utilities and nuclear fuel cycle companies are progressing on their plans to construct enrichment, reprocessing, and low-level waste storage facilities at a common site in northern Honshu. Initial operation of the facilities in the 1990s will move Japan closer to self-sufficiency in the nuclear fuel cycle.

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NUEXCO REPORT 217 FIGURES OF THE MONTH (August 31, 1986)	This Month (Report 217)	Last Month (Report 216)	12 Months Ago (Report 205)
Exchange Value[1]	17.00	17.00	16.00
Transaction Value[1]	17.45	17.50	15.10
UF_6 Value[2]	48.00	48.25	44.50
Loan Rate[3]	4%	4%	5%
Conversion Value[4]	1.90	1.80	1.60
Near-Term Uranium Supply[5]	4.2	3.9	3.3
Near-Term Uranium Demand[6]	1.5	2.7	1.2
Near-Term Supply-Demand Ratio	2.9	1.4	2.8
Recent Uranium Sales:			
Number of Transactions[7]	5	7	3
Quantity of Material[8]	1.5	1.2	0.4
Nuexco SWU Value:[9]			
at 0.3 tails assay and delivery within one year	78	78	—
USDOE SWU Prices:			
USEC	125.00[10]	125.00[10]	135.00
AFC	153.00[11]	153.00[11]	153.00[11]
Requirements	157.00[11]	157.00[11]	157.00[11]
Market Value of Enriched UF_6[12,13]:			
2.5 w/o U_{235}	458	457	459
3.0 w/o U_{235}	586	585	589
3.5 w/o U_{235}	717	715	722
4.0 w/o U_{235}	849	847	857

[1] US $ per pound U_3O_8 equivalent.

[2] US $ per kilogram U as UF_6.

[3] Per annum.

[4] US $ per pound U as UF_6.

[5] Active inquiries to sell, for delivery within 12 months after contract signing (millions of pounds U_3O_8).

[6] Active inquiries to purchase, for delivery within 12 months after contract signing (millions of pounds U_3O_8).

[7] Uranium sales only, does not include loans, conversion, or SWU transactions.

[8] Millions of pounds U_3O_8, equivalent.

[9] US $ per SWU.

[10] Effective 10/1/85.

[11] Effective 10/1/84.

[12] Calculated using the Nuexco Exchange Value, Conversion Value, and 0.30 percent tails assay. From 4/30/85 to 11/30/85, calculations used in the Nuexco SWU Value for DOE origin and delivery by the end of FY86. As of 12/31/85, calculations use the SWU Value for delivery within one year.

[13] US $ per KgU as UF_6, rounded to the nearest $.

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OCTOBER 1986 NUMBER 218

MONTHLY REPORT

ON THE NUCLEAR FUEL MARKET

NUEXCO

Three Park Central 1515 Arapahoe Street, Suite 1045 Denver, Colorado 80202

HEADQUARTERS

Chairman of the Board of Partners
Oren L. Benton

Vice Chairman of the Board of Partners and Chief Executive Officer
Samuel R. Freeman

Directors of Operations
Business and Financial Affairs — James E. Lewis
Administration — J. Fred Lawrence
Legal and Regulatory Affairs — Frederick J. Boyne

NUEXCO FUEL BROKERAGE SERVICES

Manager of Fuel Brokerage
Earl E. Hoellen, Jr.

BROKERAGE SERVICE LOCATIONS

UNITED STATES

DENVER
Three Park Central
1515 Arapahoe Street
Suite 900
Denver, Colorado 80202
Telephone: (303) 893-4015
Telecopy: (303) 825-4821
Telex: 450202 (NUEXCO DVR)

Managing Broker
Earl E. Hoellen, Jr.

MENLO PARK
Bldg. 1, Suite 105
3000 Sand Hill Road
Menlo Park, California 94025
Telephone: (415) 854-1510
Telecopy: (415) 854-2115
Telex: 470674 (NUEXCO UI)

Managing Broker
George White, Jr.

EUROPE

FERNEY-VOLTAIRE
13 chemin du Levant
01210 Ferney-Voltaire
France
Telephone: (33-50) 428035
Telecopy: (33-50) 428526
Telex: 385288 (NUEXCO F)

Managing Broker
James E. Vaughan

ZURICH
135 Zurichstrasse
CH-8700 Kusnacht
Switzerland
Telephone: (41-01) 910-8977
Telecopy: (41-01) 910-6672
Telex: 58877 (COMAG)

Managing Broker
Donald P. Ebright

REGIONAL MANAGING BROKERS

AFRICA
James E. Vaughan

AUSTRALIA
George White, Jr.

FAR EAST
Earl E. Hoellen, Jr.

NORTH AND SOUTH AMERICA
Earl E. Hoellen, Jr.

(See inside back cover for list of Representatives and Consultants.)

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MONTHLY REPORT ON THE NUCLEAR FUEL MARKET

October 1986 No. 218

R. WESLEY MILLER, *EDITOR* CLARK M. BEYER, *ASSOCIATE EDITOR*

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To Our Readers

In the *Historical Exchange Values* table on page 32 of Report 187 (March 1984), the January 1976 Exchange Value was listed incorrectly as $32.50. The error was carried over in subsequent Reports. The correct Exchange Value for January 1976, as shown on page 29 of this Report, is $35.20. Nuexco regrets any inconvenience the error may have caused.

* * *

Please note that the address of Nuexco's office in Menlo Park, California has been changed from Building 3, Suite 290 to Building 1, Suite 105. Telephone, telex and telecopy numbers are unchanged. The complete address now is:

Building 1, Suite 105
3000 Sand Hill Road
Menlo Park, California 94025
Telephone: (415) 854-1510
Telecopy: (415) 854-2115
Telex: 470674 (NUEXCO UI)

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NATURAL URANIUM AND SECONDARY MARKET CONVERSION

(All data as of September 30, 1986)

The **Exchange Value** is **$17.00** per pound U_3O_8, unchanged since last month. **Active supply** of natural uranium (concentrates and UF_6) for spot or near-term delivery totals **4,050,000** pounds U_3O_8 equivalent, down 180 thousand pounds since last month. The corresponding figure for **active demand** is **1,415,000** pounds, down 35 thousand pounds. The spot and near-term **supply-demand ratio** remained at **2.9:1.**

The *Current Market Data* section of this Report lists four natural uranium sales, involving approximately 500 thousand pounds equivalent U_3O_8. All of the transactions involved spot or near-term delivery, and three met the criteria for inclusion in the current Transaction Value calculation. Two of the transactions involved natural UF_6.

The **Transaction Value** is **$17.35** per pound U_3O_8, down $0.10 since last month. The calculation extends over a 3-month period and includes 13 transactions involving 2.4 million pounds equivalent U_3O_8.

The **UF_6 Value** is **$48.00** per kilogram U in UF_6, unchanged since last month.

The **Conversion Value** is **$1.90** per pound U in UF_6, unchanged since last month. Active supply of secondary market conversion services for delivery within three years totals 2.0 million pounds U as UF_6. Active demand totals 650 thousand pounds U as UF_6. No secondary market conversion transactions are reported.

The **Loan Rate** is **4 percent** per annum, unchanged.

* * *

The Exchange Value and UF_6 Value were unchanged this month, in the absence of significant changes in fundamental market forces. While the market appeared to weaken slightly early in September, the September 11 oral arguments in the US producers' lawsuit against DOE may have had some psychological effect on the market, even though no issues were resolved at the hearing. Market participants expecting to be affected by the outcome of the case are naturally quite interested, so the proceedings were widely publicized. The oral arguments by counsel for both sides, as well as the questions and comments offered by each of the three judges, were scrutinized closely for indications as to the ultimate outcome. Toward the end of the month, possibly as a result of speculation that the producers' position had been enhanced, the market firmed at the level of the previous month, $17.00 per pound U_3O_8 and $48.00 per kgU as UF_6.

Canadian producers continue to dominate the seller side of the market, but now seem less willing to cut prices drastically to complete a transaction. In addition, large discounts on uranium of Southern African origin may have been discontinued, effectively removing from the market any material of that origin. Such an event would undoubtedly alleviate some of the downward price pressure that has been building. As is customary in this market, discounts and premiums relative to the Exchange Value or UF_6 Value may be associated with material origin, location, form, time of payment, currency of payment, or other commercial terms and conditions.

One US producer sold a significant quantity of material at a slight premium during September, but buyers remain reluctant to pursue the purchase of US-origin material being offered at $19-$20 per pound U_3O_8. In general, US utilities probably will delay buying decisions as long as possible, hoping for some resolution to the market uncertainties associated with the current litigation and legislative actions. However, US producers may be inclined to view the market for US-origin uranium as stronger now than in the past few months, because of their assessment of the likely outcome in Albuquerque and because of the unexpected support given to the Domenici legislation by the Chief Executive Officers committee of the Edison Electric Institute, a utility trade organization. The utility endorsement of the amended, less complex Domenici bill gives the bill a much greater chance of passage, thereby increasing the likelihood that uranium usage restrictions of 40 to 50 percent will be implemented within one year.

While European buyers have been largely inactive in the last few months because of the general lack of unfilled requirements, some continue to make occasional purchases. One buyer purchased non-US origin material at a price slightly below the Exchange Value, but the results of that bidding indicate that most non-US sellers are not prepared to cut prices aggressively at present.

* * *

The Conversion Value was unchanged this month, although the supply of secondary market conversion services increased as two sellers became active. While demand increased as at least two buyers prepared to issue secondary market bid requests, buyers remain largely discretionary. Thus, because no potential sellers appear willing to cut prices to complete a sale, the market may remain inactive. Some of the active sellers have primary conversion contracts priced well above the current Conversion Value, so there is little economic incentive for those utilities to enter agreements on the secondary market unless they can realize prices well above the current level.

* * *

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ENRICHED URANIUM AND SWUS

The **SWU Value** as of September 30, 1986, is $78 per SWU, unchanged since last month. This refers to SWU at a tails assay of 0.30 weight-percent U_{235} and for delivery within one year. Three secondary market SWU transactions are reported this month, involving less than 50 thousand SWU of DOE origin.

The current secondary market for enrichment services appears to have divided into two categories. The three transactions for small quantities of DOE-origin SWU that took place during September represent one segment of that market. Some utilities are holding small quantities of DOE-origin virgin SWUs — so-called upgrade SWUs that are more valuable because they can be used to upgrade the enrichment assay of larger amounts of enriched product. These SWUs usually can be obtained at prices in the range of $85 to $100 per SWU. However, because requirements-type commitments have been replacing fixed commitments from DOE, utilities use up excess inventories, so these opportunities make up a diminishing segment of the market. The other segment consists of SWUs contained in enriched product (usually at any of several common enrichment assay levels). These opportunities are typically available in much larger quantities (on the order of 100,000 to 300,000 SWUs), and command prices near the current SWU Value.

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THE CONTINUING DECLINE OF URANIUM SPOT PRICES IN EUROPEAN AND JAPANESE CURRENCIES

The US dollar continued to decline during September against key European currencies and the Japanese yen, reaching its lowest point in several years. The result was a continuing decline of uranium spot prices expressed in those currencies. The $17.00 Exchange Value was equivalent to 34.32 Deutschmarks or 2,608 Japanese yen on September 30. These figures represent substantial declines compared to 41.87 DM and 3,413 yen when the Exchange Value reached $17.00 on December 31, 1985. Furthermore, when the Exchange Value fell to a ten-year low of $14.25 on April 30, 1985, it equalled 44.36 marks and 3,598 yen. Thus, while dollar-denominated uranium prices have risen a cumulative 19 percent since the Exchange Value bottomed in April 1985, uranium prices in Deutschmarks have fallen 23 percent, and prices in yen have fallen 28 percent (Table 1 and Figure 1).

The dollar rose steadily against the Deutschmark and the yen during 1984 as the US economy strengthened and expanded. It peaked in early 1985 and has declined steadily since then. Three principal reasons for the consistent downward trend of the US dollar relative to other currencies are the following.

1. The strong dollar in 1984, which increased the competitiveness of non-US companies in international markets, led to a competitive resurgence in European and Japanese economies and drew investment capital away from the USA.

2. The Reagan Administration, in coordinated action with European and Japanese governments, over the past year has taken steps to reduce the dollar's value. This was done to counteract record US trade deficits in lieu of protectionist trade measures proposed by the US Congress.

3. Despite the rapid decline in the dollar's value, confidence in the European and Japanese economies has remained high relative to the USA, where foreign trade deficits continue to dampen the US economy and many analysts predict further recession.

For many uranium market participants, the recovery of the dollar is of prime importance, even if the Exchange Value rises gradually over time. Some non-US sellers that have dollar-denominated contracts or that participate in the spot market are distressed by the dollar's entrenched weakness, and are anxious for a recovery. Conversely, many non-US buyers are witnessing lower spot prices almost every month despite the almost 20-percent rise in the Exchange Value (expressed in US dollars) over the last 18 months. Those buyers must decide at what point to take advantage of this bargain situation.

Table 1
EXCHANGE VALUE EXPRESSED IN US DOLLARS, GERMAN MARKS AND JAPANESE YEN SINCE APRIL 1985[1]

Date Determined	US Dollar	Cumulative Change[2] (percent)	German Mark	Cumulative Change[2] (percent)	Japanese Yen	Cumulative Change[2] (percent)
Apr 30 1985	14.25	—	44.36	—	3,598	—
May 31 1985	15.00	+ 5.3	46.30	+ 4.4	3,773	+ 4.9
Jun 30 1985	15.00	+ 5.3	45.76	+ 3.2	3,732	+ 3.7
Jul 31 1985	15.75	+10.5	44.50	+ 0.2	3,739	+ 3.9
Aug 31 1985	16.00	+12.3	44.46	+ 0.2	3,793	+ 5.4
Sep 30 1985	16.00	+12.3	42.94	− 3.2	3,458	− 3.9
Oct 31 1985	16.50	+15.8	43.43	− 2.1	3,507	− 2.5
Nov 30 1985	16.75	+17.5	42.62	− 3.9	3,368	− 6.4
Dec 31 1985	17.00	+19.3	41.87	− 5.6	3,413	− 5.1
Jan 31 1986	17.00	+19.3	40.38	− 9.0	3,275	− 9.0
Feb 28 1986	17.00	+19.3	37.89	−14.6	3,082	−14.3
Mar 31 1986	17.25	+21.1	40.19	− 9.4	3,098	−13.9
Apr 30 1986	17.25	+21.1	37.51	−15.4	2,893	−19.6
May 31 1986	17.00	+19.3	39.21	−11.6	2,923	−18.8
Jun 30 1986	17.00	+19.3	37.43	−15.6	2,810	−21.9
Jul 31 1986	17.00	+19.3	35.89	−19.1	2,640	−26.6
Aug 31 1986	17.00	+19.3	34.86	−21.4	2,651	−26.3
Sep 30 1986	17.00	+19.3	34.32	−22.6	2,608	−27.5
TOTAL NET CHANGE		+19.3		−22.6		−27.5

[1] Calculated using currency exchange rates published in the *Wall Street Journal* as of the given day.

[2] Using the April 30, 1985 Exchange Value ($14.25) as a base.

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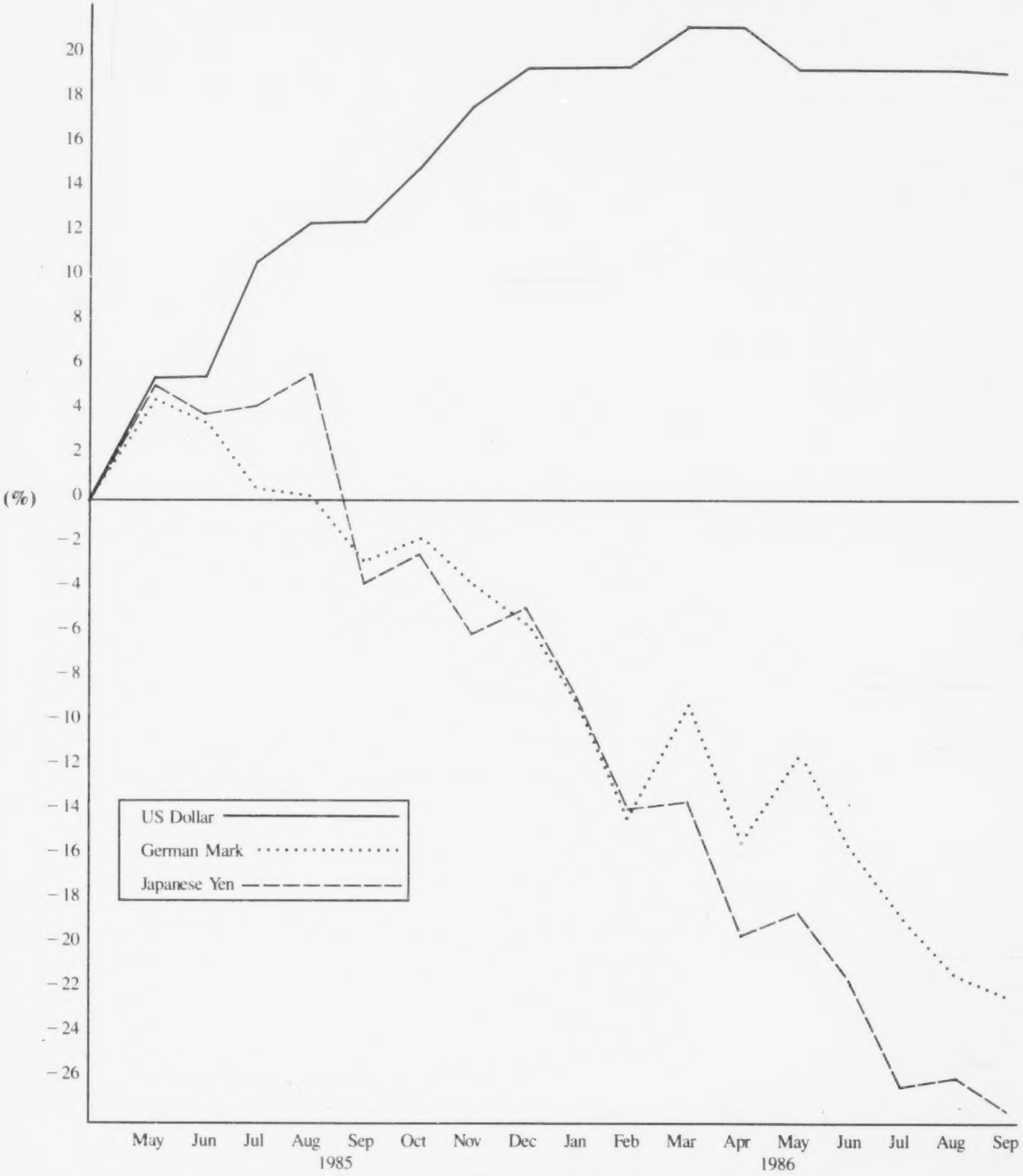
FIGURE 1. Cumulative Change in Exchange Value Since April 30, 1985
(Expressed in US Dollars, German Marks, and Japanese Yen)



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CURRENT MARKET DATA

September 30, 1986	Market Values	Active Supply[1] (thousands)	Active Demand[1] (thousands)
EXCHANGE VALUE	**$17.00**/lb. U_3O_8	4,050	1,415
UF_6 VALUE	**$48.00**/kgU		
CONVERSION VALUE	**$1.90**/lb. U as UF_6	1,965	650
SWU VALUE 0.3 tails assay; delivery within one year	**$78**/SWU		
LOAN RATE	**4%**/annum	0	0

	$/lb. U_3O_8	**Millions of Pounds**	**Number of Transactions**	**Number of Months**
TRANSACTION VALUE	**17.35**	2.4	13	3

---

[1] Supply and demand tables in *Current Market Data* section of this Report detail the numbers for each category.

DEFINITIONS

1. The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.
2. The **UF_6 Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.
3. The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.
4. The **SWU Value** represents Nuexco's judgment of the price at which transactions for the sale of significant quantities of SWUs of stated origin for delivery in the specified time period could be concluded as of the date indicated.
5. The **Loan Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.
6. The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
   - a. Transactions closed within the previous three-month period for which delivery is scheduled within one year of the transaction date;
   - b. At least ten transactions;
   - c. Transactions involving a sum total of at least 2 million pounds U_3O_8 equivalent.

   The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

DERIVATIONS AND COMMENTS

1. All Market Values are based on:
   - a. Data from recently completed transactions.
   - b. Data from pending transactions.
   - c. Firm bids to buy or borrow, and firm offers to sell or lend.
   - d. Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell or lend.
2. Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these Market Values.
3. In the determination of the Conversion Value, Nuexco does not consider transportation charges other than those customarily provided by primary suppliers of conversion services.
4. The prices of conversion services or SWUs delivered under long-term contracts with primary suppliers are not considered in the determination of either the Conversion Value or SWU Value.
5. For the SWU Value, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight-percent U_{235} and a product assay of 3.0 weight-percent U_{235}, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
6. In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

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CURRENT MARKET DATA

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
Country (currency)	**This Month (Sep 30, 1986)**	**Last Month (Aug 31, 1986)**	**12 Months Ago (Sep 30, 1985)**	**This Month (Sep 30, 1986)**	**Last Month (Aug 31, 1986)**	**12 Months Ago (Sep 30, 1985)**
Australia (dollar)	27.06	27.91	22.79	70.34	72.55	59.25
Belgium (comm. franc)	714.29	720.03	866.27	1,857	1,872	2,252
Canada (dollar)	23.58	23.66	21.98	61.32	61.51	57.15
Finland (markka)	83.37	83.50	91.90	216.75	217.07	238.92
France (franc)	112.29	114.25	130.61	291.92	297.02	339.56
FRG (mark)	34.32	34.86	42.94	89.21	90.64	111.64
Italy (lira)	23,800	24,021	29,154	61,873	62,450	75,795
Japan (yen)	2,608	2,651	3,458	6,780	6,893	8,991
Netherlands (guilder)	38.90	39.26	48.28	101.14	102.07	125.52
South Africa (rand)	37.53	43.93	40.30	97.56	114.20	104.78
Spain (peseta)	2,269	2,274	2,611	5,900	5,911	6,789
Sweden (krona)	117.48	117.57	128.51	305.43	305.64	334.11
Switzerland (franc)	27.81	28.13	35.15	72.31	73.12	91.38
UK (pound)	11.85	11.49	11.37	30.80	29.87	29.55
US (dollar)	17.00	17.00	16.00	44.20	44.20	41.60

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
Country (currency)	**This Month (Sep 30, 1986)**	**Last Month (Aug 31, 1986)**	**12 Months Ago (Sep 30, 1985)**	**This Month (Sep 30, 1986)**	**Last Month (Aug 31, 1986)**	**12 Months Ago (Sep 30, 1985)**
Australia (dollar)	27.61	28.64	21.51	71.79	74.47	55.92
Belgium (comm. franc)	728.99	739.09	817.54	1,895	1,921	2,125
Canada (dollar)	24.07	24.29	20.74	62.58	63.14	53.93
Finland (markka)	85.09	85.71	86.73	221.22	222.82	225.48
France (franc)	114.60	117.27	123.27	297.93	304.88	320.46
FRG (mark)	35.02	35.79	40.53	91.05	93.04	105.36
Italy (lira)	24,290	24,657	27,514	63,147	64,104	71,531
Japan (yen)	2,661	2,721	3,264	6,919	7,075	8,486
Netherlands (guilder)	39.70	40.30	45.56	103.22	104.77	118.46
South Africa (rand)	38.30	45.09	38.04	99.57	117.22	98.88
Spain (peseta)	2,316	2,334	2,464	6,021	6,067	6,407
Sweden (krona)	119.90	120.68	121.29	311.72	313.74	315.31
Switzerland (franc)	28.39	28.87	33.17	73.80	75.06	86.24
UK (pound)	12.09	11.79	10.73	31.43	30.66	27.89
US (dollar)	17.35	17.45	15.10	45.11	45.37	39.26

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on Sept. 30, 1986.

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CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

	per lb. U as UF_6			per kg. U as UF_6		
Country (currency)	**This Month (Sep 30, 1986)**	**Last Month (Aug 31, 1986)**	**12 Months Ago (Sep 30, 1985)**	**This Month (Sep 30, 1986)**	**Last Month (Aug 31, 1986)**	**12 Months Ago (Sep 30, 1985)**
Australia (dollar)	3.02	3.12	2.28	6.67	6.88	5.02
Belgium (comm. franc)	79.83	80.47	86.63	176.00	177.42	190.98
Canada (dollar)	2.64	2.64	2.20	5.81	5.83	4.85
Finland (markka)	9.32	9.33	9.19	20.54	20.57	20.26
France (franc)	12.55	12.77	13.06	27.67	28.15	28.80
FRG (mark)	3.84	3.90	4.29	8.46	8.59	9.47
Italy (lira)	2,660	2,685	2,915	5,864	5,919	6,427
Japan (yen)	291.46	296.32	345.87	642.55	653.27	762.51
Netherlands (guilder)	4.35	4.39	4.83	9.59	9.67	10.64
South Africa (rand)	4.19	4.91	4.03	9.25	10.82	8.89
Spain (peseta)	253.64	254.11	261.14	559.17	560.22	575.71
Sweden (krona)	13.13	13.14	12.85	28.95	28.97	28.33
Switzerland (franc)	3.11	3.14	3.51	6.85	6.93	7.75
UK (pound)	1.32	1.28	1.14	2.92	2.83	2.51
US (dollar)	1.90	1.90	1.60	4.19	4.19	3.53

SWU VALUE AND UF_6 VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	**SWU Value delivery within one year (Sep 30, 1986)**	**UF_6 Value per kg.U in UF_6 This Month (Sep 30, 1986)**	**UF_6 Value per kg.U in UF_6 Last Month (Aug 31, 1986)**
Australia (dollar)	124.14	76.40	78.79
Belgium (comm. franc)	3,277	2,017	2,033
Canada (dollar)	108.21	66.59	66.81
Finland (markka)	382.54	235.41	235.76
France (franc)	515.19	317.04	322.58
FRG (mark)	157.45	96.89	98.44
Italy (lira)	109,198	67,199	67,825
Japan (yen)	11,965	7,363	7,486
Netherlands (guilder)	178.49	109.84	110.85
South Africa (rand)	172.19	105.96	124.03
Spain (peseta)	10,412	6,408	6,420
Sweden (krona)	539.05	331.72	331.95
Switzerland (franc)	127.62	78.53	79.42
UK (pound)	54.36	33.45	32.44
US (dollar)	78.00	48.00	48.00

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[1] Calculated using currency exchange rates published in the *Wall Street Journal* on Sept. 30, 1986.

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CURRENT MARKET DATA

RECENT TRANSACTIONS[1]

Uranium Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price as Percent of Current Exchange or UF_6 Value	Seller	Buyer	Remarks
3807	1986	50-100	103	Producer	Utility	
3803	1986	50-100	99	Producer	Utility	UF_6.
3802	1987	101-300	99-100	Producer	Utility	
3795	1986	50-100	R[5]	Producer	Utility	UF_6.

Enrichment Services
Secondary Market Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity[2] (thousands of SWUs)	Approximate Price[3] as Percent of Current SWU Value[4]	Seller	Buyer	SWU Origin	Remarks
3806	1987	less than 50	R[5]	Utility	Utility	DOE	
3800	1987	less than 50	109	Trader	Utility	DOE	
3796	1987	less than 50	106	Utility	Trader	DOE	

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[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] If tails assay is unknown or unspecified, Nuexco's calculation of SWU quantity assumes 0.20 w/o tails assay.

[3] Price is not normalized to 0.20% tails assay.

[4] Refers to SWU Value that corresponds to SWUs included in transaction. When prices and SWU values are expressed as discounts (e.g., X dollars less than DOE's USEC base price at time of delivery), the percentage refers to the ratio of the *discounts*, not the ratio of the prices.

[5] The notation *R* means that Nuexco either does not know, or that Nuexco has restricted that information to protect client confidentiality.

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URANIUM SUPPLY
(September 30, 1986)

	Delivery Period[1] (Thousands of Pounds U_3O_8)		
Nuexco Project Number	**Spot or Near-term[2]**	**Intermediate or long-term**	**Remarks**
Available for Sale:			
ACTIVE			
2335	400	—	
2740	100	—	
2764	260	—	UF_6
2777	500	—	
2885B	325	—	UF_6
2889	100	—	
2933*	300	300 per year	1988-90
2967*	200	—	
2973	15	—	
2989	40	—	
3023	500	500	UF_6
3121	1,200	—	
3127*	110	—	
2263*	—	400 per year	1988 on
2625*	—	500 per year	1988 on
2781	—	250 per year	1988-95
2927*	—	220 per year	1988-90
2981	—	600 per year	1988-91
TOTAL:	4,050		
INACTIVE			
2297	200	200 per year	1988-89
2336*	250	250 per year	1988-94
2389*	75	75 per year	1988-90
TOTAL:	525		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2703, 2765, 2810, 2813.

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CURRENT MARKET DATA

URANIUM DEMAND
(September 30, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or long-term	Remarks
Inquiries to Purchase: ACTIVE			
2782*	900	700	UF_6 or U_3O_8; 1988
2784	100	—	
2948*	100	—	UF_6
2954*	50	1,000 per year	1987-90
2955*	265	—	
2738	—	1,000	1989 on
2739*	—	1,000 per year	1987-90
3019	—	200	1988-91
TOTAL:	1,415		
INACTIVE			
2760*	750	750 per year	1988-90
2798	70	—	
2877	300	—	
2893	200	—	
2681	—	500	UF_6 or U_3O_8; 1988
2936*	—	400 per year	1988-95
TOTAL:	1,320		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 2661, 2733, 2857, 2898, 2951, 3014, 3018.

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LOAN SUPPLY AND DEMAND
(September 30, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Within 1 Year	Beyond 1 Year	Remarks
Available for Loan:			
INACTIVE			
1938	2,000	—	UF_6
2036	500	—	
2667	800	—	
2920	2,000	—	
TOTAL:	5,300		

*New or revised since last month.

[1] Measured from the date of this Report.

Projects removed since last month: None.

No inquiries to borrow are reported this month.

CONVERSION SUPPLY AND DEMAND
(September 30, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U as UF_6) Within 3 Years	Beyond 3 Years	Remarks
Available for Sale:			
ACTIVE			
2849	550	500	1987-90
2859	750	750	
2935*	500	—	
2988*	165	—	
TOTAL:	1,965		
Inquiries to Purchase:			
ACTIVE			
2833	400	—	
2949*	250	—	
TOTAL:	650		

*New or revised since last month.

[1] Measured from the date of this Report.

Projects removed since last month: 2931.

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CURRENT MARKET DATA

SWU SUPPLY AND DEMAND
(September 30, 1986)

Nuexco Project Number	Delivery Period[1] (Thousands of SWUs) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
2571	—	55	1987
2855	250	—	
TOTAL:	250		
INACTIVE			
2410A	340	—	
2873	40	—	
2953	200	—	
TOTAL:	580		
Inquiries to Purchase:			
INACTIVE			
2878	60	—	
2879	250	—	
2923*	15	—	
2999	—	300	
3015	85	—	
TOTAL:	410		

*New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes SWUs deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 3026.

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THE TAILS ASSAY SWAP

Introduction

In the past few years, one of the mechanisms used to facilitate transactions involving uranium and enrichment services has been the tails assay swap. While the advent of the Utility Services Enrichment Contract (USEC) has, in most cases, eliminated the advantages of the tails assay swap, there are still some utilities which could benefit from the technique, in that it can enable a utility to exchange some of its natural uranium inventory for enrichment services, thereby reducing the amount of cash needed to procure a given amount of nuclear fuel. In the tails assay swap, a utility with a fixed SWU commitment from DOE delivers excess natural feed to DOE, fixes the tails assay, and then sells the SWU component of the excess enriched product at competitive prices on the secondary market. This article explains the process and provides examples of how utilities and intermediaries have performed such transactions in the past.

Background

Both primary and secondary market enrichment transactions are based on the concept of exchanging feed material (natural UF_6) plus cash for enriched UF_6 product. Most fuel for commercial nuclear power plants requires enrichments (product assays) in the range of approximately two to four weight-percent (w/o) U_{235}. The weight-percent of U_{235} in the waste stream is referred to as the tails assay, and it generally varies between 0.2 and 0.3 w/o U_{235}. Although the *physical* tails assay is fixed at the enrichment plant, there is a *transaction* tails assay for any enrichment transaction that determines in what relationship the feed and money (for SWUs) will be given to the enricher for the desired quantity of product.

Because of the relationship between feed quantity, product assay, and tails assay, higher tails assays require more natural uranium feed (and fewer SWUs) to produce a given quantity of enriched product at a given product assay. Conversely, lower tails assays require less natural feed (and more SWUs) to produce the same quantity of enriched product at the same product assay. Thus, depending on the relative costs of enrichment services and a utility's uranium costs, the utility can determine its *optimum tails assay*, or that assay which results in the lowest cost for enriched product for a particular utility's fuel economics. (Reports 195, 196, and 197 [November 1984 through January 1985] contain a three-part article on the Optimum Tails Assay.)

Prior to the issuance of the USEC, two basic enrichment contracts were in effect. The Requirements-type contract allowed a utility to specify the quantity of SWUs desired in a given year with as little as 180 days notice. The Adjustable, Fixed-commitment (AFC) contract specified fixed quantities of SWU that had to be taken in each year of the contract. Because from DOE's standpoint the AFC contract was essentially less risky than the Requirements contract, the price per SWU under the AFC contract was historically below the price per SWU under the Requirements contract. When the USEC was issued, DOE set a number of terms for converting the old contracts to the USEC, and other terms were negotiated by the individual utilities. As a result, depending on each utility's previous contract, its duration and the utility's negotiations with DOE, some utilities were left with fixed commitments for FY84, FY85, and FY86.

Therefore, despite the overwhelming acceptance of the USEC, which is basically a Requirements-type contract, some utilities still had fixed commitments to take through FY86. In addition, following many plant cancellations during the 1970s and early 1980s, many utilities became oversupplied with uranium and SWUs. The tails assay swap worked best for those utilities that were both overcommitted and had further fixed commitments. Moreover, to use the technique the utility had to be able to specify any tails assay between 0.2 and 0.3 w/o. The following example shows how a utility could take its fixed-commitment SWU delivery, vary its tails assay and supply additional feed, and realize a profit on the secondary-market sale of the SWU component in the excess enriched product.

Scenario

Assume that Utility A has a fixed-commitment delivery for 100,000 SWU and specifies 3.0-percent enriched product. Because of high feed costs, Utility A specifies a tails assay of 0.2 w/o, to reduce the amount of feed it must supply. With the parameters of

— 100,000 SWU,
— 0.2 w/o tails assay,
— and 3.0 w/o product enrichment,

Utility A would have to deliver 127,244 kgU as natural UF_6 to DOE and would in turn receive 23,224 kgU as UF_6 enriched to 3.0 w/o.

In order to exploit the tails assay swap technique, Utility A could instruct DOE to change the tails assay to 0.3 w/o. Utility A would need to deliver more feed, but would receive from DOE a greater amount of enriched product. With 100,000 SWU, 3.0 percent enrichment, and *0.3 w/o tails assay*, Utility A would deliver 191,795 kgU as UF_6n, and would receive 29,197 kgU as UF_6e. In essence, Utility A must obtain 64,551 kgU as UF_6n *in additional feed* in order to acquire an excess of 5,973 kgU as UF_6e of enriched product (Figure 2).

At this point, Utility A could use an intermediary to acquire the extra 64,551 kgU of natural feed needed for the 0.3 tails

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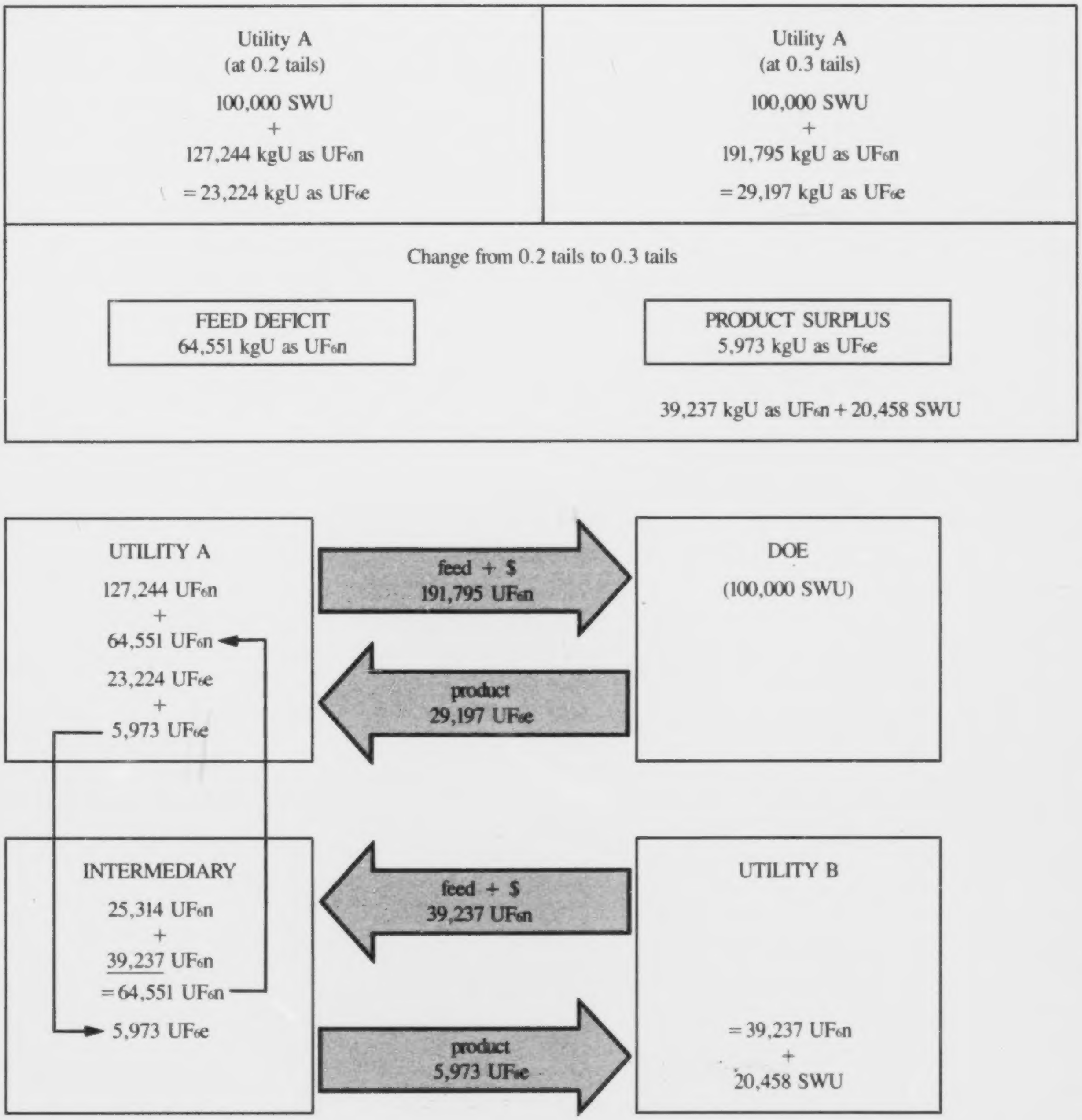
Utility A
(at 0.2 tails)
100,000 SWU
+
127,244 kgU as UF$_6$n
= 23,224 kgU as UF$_6$e
Utility A
(at 0.3 tails)
100,000 SWU
+
191,795 kgU as UF$_6$n
= 29,197 kgU as UF$_6$e
Change from 0.2 tails to 0.3 tails
FEED DEFICIT
64,551 kgU as UF$_6$n
PRODUCT SURPLUS
5,973 kgU as UF$_6$e
39,237 kgU as UF$_6$n + 20,458 SWU
UTILITY A
127,244 UF$_6$n
+
64,551 UF$_6$n
23,224 UF$_6$e
+
5,973 UF$_6$e
feed + $
191,795 UF$_6$n
product
29,197 UF$_6$e
DOE
(100,000 SWU)
INTERMEDIARY
25,314 UF$_6$n
+
39,237 UF$_6$n
= 64,551 UF$_6$n
5,973 UF$_6$e
feed + $
39,237 UF$_6$n
product
5,973 UF$_6$e
UTILITY B
= 39,237 UF$_6$n
+
20,458 SWU

Figure 2. SCHEMATIC OF A HYPOTHETICAL TAILS ASSAY SWAP.

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assay, in exchange for the extra 5,973 kgU of enriched product that will result from the higher tails. Utility A is indifferent, still having purchased the 100,000 SWU required under its contract with DOE, and having delivered the same amount of feed that it had planned to deliver at 0.2 w/o tails assay. At 3.0 percent enrichment and 0.3 tails, the 5,973 kgU of excess enriched product contains

— 39,237 kgU of natural feed, and
— 20,458 SWU.

The intermediary then approaches Utility B, offering to sell it 20,458 SWU (contained in the excess enriched product) at 0.3 w/o tails. Utility B delivers the appropriate feed component (39,237 kgU as UF_{6n}), plus the sales price of the SWU component.

To determine the price at which to sell the SWU to Utility B, the intermediary must consider what the cost will be to purchase the extra feed needed to supply Utility A; in other words, the cost of buying the feed not provided by Utility B.

64,551 kgU needed for Utility A
− 39,237 kgU supplied by Utility B
= 25,314 kgU that must be purchased by intermediary.

Assuming the intermediary could obtain the remaining feed for $55.00 per kgU, then

(25,314 kgU)($55.00/kgU) = $1,392,270

$$\frac{\$1{,}392{,}270}{20{,}458\ \text{SWU}} = \mathbf{\$68.06\ per\ SWU}$$

In this example, then, the $68.06 per SWU represents the breakeven price for the intermediary. However, if feed costs rise to $60 per kgU of UF_{6n}, then

(25,314 kgU)($60.00/kgU) = $1,518,840

$$\frac{\$1{,}518{,}840}{20{,}458\ \text{SWU}} = \mathbf{\$74.24\ per\ SWU}$$

and the breakeven SWU price rises to $74.24 per SWU.

Obstacles to the Technique

The chief reason that tails assay schemes are becoming extinct is the terms and conditions of the USEC. Because it essentially is a Requirements-type contract, the USEC does not obligate utilities to take a fixed amount of SWUs each year for the duration of the contract. Thus, those utilities that converted their old AFC and Requirements contracts to the USEC will, under most circumstances, purchase the least amount of SWUs possible to enrich their feed by specifying 0.3 w/o tails assay. Moreover, most fixed commitments left over from the AFC contracts that were converted to the USEC ended in FY86. Unless a utility is under contract to accept substantially more SWUs each year than it might need, there is little motivation to become involved in a tails assay swap. Moreover, as primary (and, by extension, secondary) market prices for SWUs decrease *relative to the price of natural* UF_6, the breakeven price of the SWU component contained in the excess enriched product moves closer to secondary market SWU prices, reducing the profit margin in the transaction.

CORRECTION

Two errors in the Nuclear Electric Generating Capacity article in last month's Report (September 1986, #217, page 10) warrant correction.

1. In the section on Spain, the text states that five plants under construction were canceled by the government in 1984. In actuality, those units were *deferred*, a critical distinction in that engineering and some construction work is continuing at several of the sites. As shown in Table 2B of the article, Nuexco's forecast predicts that several of the deferred units will be reinstated in the government's energy plan for the 1990s.

2. Belgium's seven operating nuclear plants account for *50 to 80 percent* of the country's electricity production, as opposed to the figure of 80 percent stated in the article.

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SOUTH AFRICA

The Atomic Energy Corporation of South Africa Limited (AEC), recently released a report entitled "Uranium in South Africa 1985." The report, formerly issued under the auspices of NUCOR (Nuclear Development Corporation of South Africa), contains the updated official assessment of South African uranium resources and production capabilities. (In 1985, NUCOR and UCOR [Uranium Development Corporation of South Africa] were consolidated under the leadership of the AEC.) The report includes the latest official evaluation of trends in uranium exploration, production and prices, as well as discussions of geology and national policy matters.

Although the confidentiality of such information is closely guarded in South Africa, terms of the Nuclear Energy Act of 1982 provide for the release of certain data to the AEC, which summarizes that information and publishes it in a biennial report. The report contains some of the most comprehensive information available regarding the South African uranium industry.

As in past reports, the AEC reassessed the country's uranium resource potential, expressing the total recoverable resources and their associated costs in terms of Reasonably Assured Resources (RAR) and Estimated Additional Resources (EAR). In essence, RAR refer to uranium that occurs in deposits known to facilitate recovery within given production cost ranges (less than $80 per kgU and $80 to $130 per kgU) using current technology. Category 1 of EAR refers to uranium that is expected to occur in extensions of known deposits, but where specific data to classify the resource as RAR is inadequate.

Table 2 summarizes the AEC findings during 1985. The AEC estimated that as of January 1, 1985, South African resources in the RAR and EAR-1 categories, recoverable at costs less than $130 per kgU ($50 per pound U_3O_8), totaled 483,300 metric tons uranium (1.256 billion pounds U_3O_8). This figure represents an increase of five percent from the January 1983 figure of 460,000 MTU. Extensive exploration in the Witwatersrand Basin contributed to the 23,000 MTU increase, as did the decline of the dollar relative to the rand, which effectively lowered mining costs in dollar terms, moving certain resources into lower cost categories.

The AEC reported production statistics of 5,732 MTU (14.9 million pounds U_3O_8) in 1984, declining 15 percent to 4,880 MTU (12.7 million pounds U_3O_8) in 1985. The decline was generally attributed to poor market conditions for uranium, despite the fact that most of South Africa's uranium production is committed to long-term contracts.

Other notable items in the AEC report include the following:

1. All of the nation's uranium is produced as a by-product, mostly of gold production in the quartz-pebble conglomerates of the Witwatersrand Group, of which the Central Rand Group is believed to contain 87 percent of South Africa's uranium resources in the lower-cost categories. A small amount (185 MTU, or about three percent of the nation's total in 1985) is produced as a by-product of copper mining at Palabora Mining Company's open-pit mine.
2. South Africa supplied 13 percent of the world's uranium in 1985, second only to Canada.
3. The country holds 14 percent of the world's resources in the RAR and EAR-1 categories, exploitable at costs less than $130 per kgU, second to Australia.

UNITED STATES

An article in Report 217 (September 1986, page 22) examined various legislative measures introduced in the US Congress, all of which could have a significant impact on the international nuclear fuel industry. Near the end of September, a bill concerning sanctions against South Africa (S. 2701) moved through the legislative process with strong support, and was placed before President Reagan for his signature. Among other provisions, the bill would prohibit imports of South African uranium ore or uranium oxide into the United States. On September 26, Reagan vetoed the measure, as had been expected. Shortly thereafter, as Congress mobilized in an attempt to override the veto, Reagan offered to invoke new sanctions by executive order. The proposed executive order would have prohibited the import of South African iron and steel, but apparently not uranium. However, the House of Representatives voted 313-83 to override the veto and thereby effectively rejected the President's last-minute offer.

Shortly after the House vote, the Senate voted 78 to 21 to override the veto, making the bill a law despite opposition from the President. However, the vague language contained in certain provisions will leave much of the law to interpretation by the Executive Branch. Those ambiguities may have been drafted deliberately to assure the bill's passage. Nevertheless, it is uncertain whether imports of South African uranium in any form will be allowed, or whether such import limitations are applicable to non-US entities that intend to remove the uranium at a later date. DOE can be expected to lobby for a lenient interpretation of the language, since some of its non-US enrichment customers have contracts with South African suppliers. Those customers would be forced to divert that material to DOE's competitors in Europe. In addition, there is a question whether companies will be allowed to import UF_6 into the USA. The language of the law does not specifically *prohibit* the importation of UF_6, but that issue may well be decided by the agency designated to interpret the law.

At present, it appears that more than one government agency may have jurisdiction in the interpretation of the law, including the

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Table 2

SOUTH AFRICA'S URANIUM RESOURCES IN THE RAR AND EAR-1 CATEGORIES[1] AS OF JANUARY 1, 1985, AND JANUARY 1, 1983[2]

(Expressed in metric tons U)

Principal Deposits or Provinces	Reasonably Assured Resources (RAR)[3]		Estimated Additional Resources (EAR)[4]		Percent of Total[5]
	$0-$80/kgU	$80-$130/kgU	$0-$80/kgU	$80-$130kgU	
Witwatersrand Basin Conglomerates	199,300	55,000	90,600	25,100	77
	(163,000)	(50,000)	(98,000)	(43,000)	(77)
Witwatersrand Basin Tailings	34,100	16,700	—	—	11
	(22,000)	(21,000)	(—)	(—)	(9)
Palabora	5,500	—	—	1,600	2
	(2,000)	(—)	(—)	(—)	(1)
Karoo Sequence	17,700	29,700	6,900	—	11
	(4,000)	(50,000)	(1,000)	(5,000)	(12)
Surficial	—	700	—	400	0
	(—)	(1,000)	(—)	(—)	(1)
TOTAL RESOURCES	256,600	102,100	97,500	27,100	
	(191,000)	(122,000)	(99,000)	(48,000)	(100)

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[1] Exploitable at costs of less than $130/kgU.

[2] Estimates as of January 1, 1983 are shown in parentheses.

[3] Reasonably Assured Resources (RAR) refers to uranium that occurs in known mineral deposits of such size, grade and configuration that it could be recovered within the given production cost ranges with currently proven mining and processing technology. Estimates of tonnage and grade are based on specific sample data and measurements of the deposits and on knowledge of deposit characteristics. Reasonably Assured Resources have a high assurance of existence and in the cost category below $80/KgU are considered as *reserves* for the purposes of this table.

[4] Estimated Additional Resources-category 1 (EAR-1) refers to uranium in addition to RAR that is expected to occur, mostly on the basis of direct geological evidence in extensions of well-explored deposits and in deposits in which geological continuity has been established but where specific data and measurements of the deposits and knowledge of the deposits' characteristics are considered to be inadequate to classify the resource as RAR. Such deposits can be delineated and the uranium subsequently recovered, all within the given cost ranges. Estimates of tonnage and grade are based on such sampling as is available and on knowledge of the deposit characteristics as determined in the best-known parts of the deposit or in similar deposits. Less reliance can be placed on the estimates in this category than on those for RAR.

[5] Column may not add due to rounding.

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Department of Commerce, the Nuclear Regulatory Commission, the Department of State, and the US Customs Department. There have been no statements as to which of those bodies has jurisdiction, nor has there been any comment from those agencies, many of which have not yet seen the legislation. A most important issue which will certainly be raised is whether, in the interests of free trade and foreign relations, non-US companies will be allowed to bring South African uranium into the USA for conversion or enrichment as long as the material is destined for use in another country.

* * *

Both sides in the US uranium producers versus DOE lawsuit presented oral arguments September 11 in the Tenth Circuit Court of Appeals in Albuquerque, New Mexico. Although observers had speculated that the proceedings might give an indication as to how the three judges would rule, there were no surprises from either the litigants or the court in what amounted to a routine hearing. The presentations by counsel for the producers and DOE, each lasting approximately 30 minutes, largely followed their respective appeal briefs submitted previously. The hearing chiefly served as an opportunity for the court to ask questions of counsel in areas of the case that needed explanation or elaboration. Despite the expectations of many market participants, the hearing provided no reliable indication as to the eventual outcome of this case.

Although the appeal covered the District Court ruling on Count I (pertaining to enrichment of foreign uranium) as well as Count II (pertaining to the Utility Services Enrichment Contract [USEC]), the emphasis of counsel and the court was clearly on Count I. Nevertheless, DOE counsel did make several points regarding Count II. Some of the main points brought up by the court and the counsel on both counts are summarized as follows.

1. DOE opened by arguing that the producers, since they are not customers of DOE and were not injured by the issuance of the USEC, did not have "standing," or grounds, to challenge the contract. If the appeals court determines that the issue of standing was not properly addressed in the District Court, the issue may be remanded (returned) to the District Court.

2. DOE maintained that the USEC, although it represented a substantial change in the way DOE marketed its enrichment services, was entirely within the boundaries of the existing enrichment criteria. Counsel stated that the producers' complaint against the USEC was "an ill-chosen vehicle designed to coerce DOE into changing long-standing policies that have nothing to do with the Utility Services Contract."

3. Regarding the imposition of limitations on the enrichment of foreign-origin uranium for use in US plants, DOE stated that the statutory language of section 161(v) of the Atomic Energy Act was the only relevant issue. DOE disagreed with the producers' contention that *if* the industry is nonviable, *then* DOE must restrict the enrichment of foreign-origin uranium. DOE believes that this is true "when and only when such measures will assure the viability of the US uranium industry." According to DOE's study, such measures will *not* assure that viability, and restrictions would only harm DOE's competitiveness in the world market for enrichment services.

4. The court asked DOE counsel whether DOE was not in fact required by the statute to "do something" when the US uranium industry became nonviable. DOE counsel responded that it is only required to make an annual report of viability to Congress, implying that it is Congress' responsibility to pass legislation to assist the industry. Moreover, it is DOE's position that imposing restrictions on the enrichment of foreign-origin uranium would not help the domestic producers. Finally, DOE claimed that its interpretation of the statute is at least as reasonable as the producers' interpretation.

5. Counsel for the producers argued that DOE has the mandate to impose enrichment limitations at any time, and has done so in the past. Moreover, the nonviability determination acts as a trigger that should have caused DOE to implement restrictions immediately in support of the domestic industry.

6. The producers' counsel also maintained that a 100-percent restriction on the enrichment of foreign uranium for use in US plants would increase the demand for US-origin uranium, thereby significantly bolstering the US production industry in a relatively short time. In summary, he stated that DOE should not be allowed to ignore a Congressional mandate to support the US uranium production sector.

At this stage, the Circuit Court of Appeals may take any of a number of possible actions. Certain issues may be remanded to the District Court for further findings, any or all of the District Court's order may be upheld, or the entire case may be overturned. If the District Court ruling is substantially upheld, DOE may well petition the US Supreme Court for a review. However, the Supreme Court may refuse to hear the case, at which point DOE's judicial options would be exhausted. In any event, some decision from the Circuit Court is expected before the end of the year, although the decision itself may not indicate the exact outcome of the case.

THE OLYMPIC DAM PROJECT: PROGRESS REPORT

Introduction

Construction of commercial production facilities at Australia's Olympic Dam (Roxby Downs) multi-mineral deposit began in March 1986, over a decade after mineralization was discovered by Western Mining Corporation Ltd. (WMC) on a mineral lease that includes part of the Roxby Downs pastoral station in South Australia. Subsequent exploration and delineation drilling revealed mineable reserves of copper, uranium, gold, and silver. Indeed, it is one of the largest mineral deposits ever discovered, containing over two billion metric tons of ore with average grades of 1.6 percent copper, 0.06 percent U_3O_8 and 0.6 grams per tonne (g/t) of gold. The deposit covers an area of approximately 20 square kilometers, and further delineation using surface drilling techniques is continuing. Nuexco Report 184 (December 1983, page 27) contains details of early project activity and geologic information.

WMC, through its wholly-owned subsidiary Roxby Mining Corporation Pty. Ltd., controls 51 percent of the project, and the BP Group controls the remainder — 36.5 percent through BP Australia Ltd., and 12.5 percent through BP Petroleum Development Ltd. Capital expenditures from the project's beginning through March 5, 1986 totaled A$192 million. Commitment to a full-scale construction project required the partners to appropriate approximately A$560 million in additional capital funding for the initial projects. The schedule calls for annual production of 30,000 tonnes of refined copper, 5.2 million pounds of uranium oxide (U_3O_8), and about 90,000 ounces of gold. The first copper, uranium and gold production is scheduled for mid-1988.

The project, as originally conceived, was based on annual copper production of 150,000 tonnes, which could be associated with about 4,000 tonnes of U_3O_8; no decision has been made at present as to the timing of expansion to these production levels, which will be arranged to meet market opportunities. The first expansion will increase copper production to about 55,000 tonnes annually. Gold production will be a function of annual ore throughput.

The partners' commitment to the initial project was based on its viability as determined in late 1985. Since then, expected revenue has been enhanced by rising gold prices and a substantial decline in the Australian dollar relative to most other major currencies. Subsequent expansion of production will be determined in light of market opportunities at the time.

Metallurgical processing facilities to be constructed will include a concentrator, smelter and refinery for copper production, a hydrometallurgical plant for uranium extraction and recovery, and a gold plant for the production of gold bullion. On-site support facilities installed for the pilot-testing stage of mining and processing will also be upgraded as necessary to meet increased production capacities. In addition, a townsite to accommodate about 3,000 persons will be constructed about 11 kilometers south of the mine area. The State Government will provide certain community facilities based on a population of up to 9,000 persons.

History of the Project

The project area is located at Olympic Dam, about 520 kilometers northwest of Adelaide in a remote semi-desert area of South Australia (Figure 3). The deposit is situated on the northwestern edge of the Stuart Shelf, a geologic feature that is known to host scattered occurrences of sulfide mineralization. Following more than ten years of research and exploration for copper in the historic copper mining region on Yorke Peninsula, south of Olympic Dam, WMC developed a model for sedimentary copper occurrences formed by the enrichment of groundwaters passing through basaltic rocks. The new exploration target became strata-bound copper deposits. Exploration efforts shifted northward in 1973, eventually concentrating on that portion of the Stuart Shelf west of the Flinders mountain range. Figure 3 shows the location of the project area, as well as some of the area's general geologic features.

The Stuart Shelf region was selected for copper exploration on the basis of favorable interpretation of a regional geophysical survey conducted by the Commonwealth Bureau of Mineral Resources and the South Australian Department of Mines and Energy. A number of potential target areas were selected for detailed evaluation based on individual gravity and magnetic anomalies caused by local and regional tectonic features. The Olympic Dam and Acropolis areas were selected for preliminary drilling to determine the geologic relationship to those geophysical anomalies. In July 1975, the first hole drilled on the Olympic Dam site encountered 38 meters of low-grade copper mineralization (1.05 percent Cu) at a depth of 353 meters. Later drilling performed at Acropolis also revealed low-grade copper mineralization, demonstrating the success of the geologic concept for strata-bound copper deposits.

At first, subsequent drilling was less encouraging. The next eight holes drilled were barren or indicated only marginal mineralization. The tenth hole, drilled in 1976, intersected 170 meters of mineralization containing 2.1 percent copper and over one pound of U_3O_8 per tonne. The extent of mineralization was generally defined following three years of wide-spaced drilling. The joint venture partnership was formed in July 1979, followed

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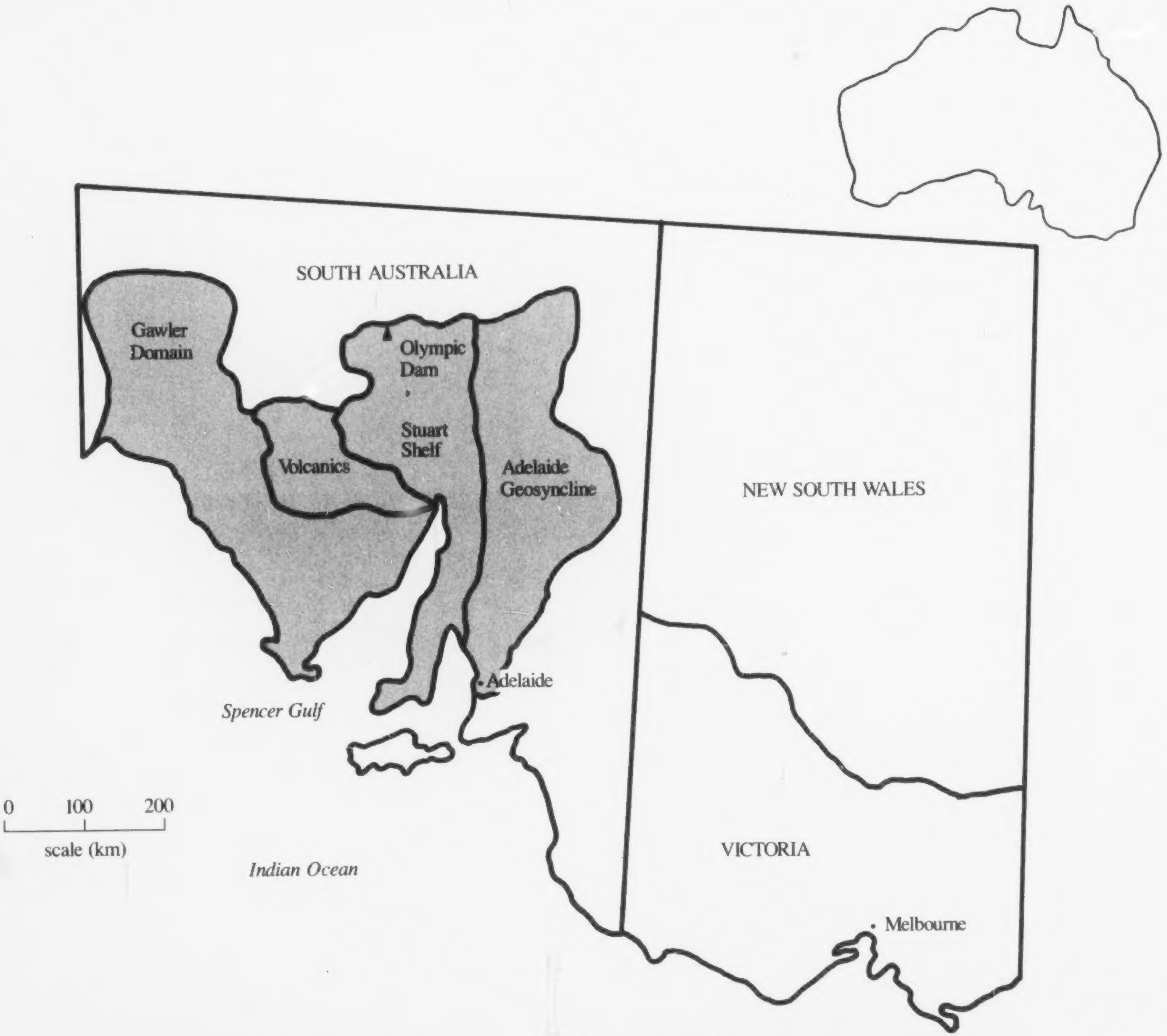
SOUTH AUSTRALIA
NEW SOUTH WALES
VICTORIA
Gawler Domain
Volcanics
Olympic Dam
Stuart Shelf
Adelaide Geosyncline
Adelaide
Melbourne
Spencer Gulf
Indian Ocean
0
100
200
scale (km)

Figure 3. Olympic Dam location map, South Australia, showing relationship to prominent geologic features.

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immediately by more detailed delineation drilling of the ore deposit. Over 500 holes were drilled, ranging in depth from 600 to 1,300 meters, at an approximate cost of A$100 per meter. That drilling campaign identified a large internal high-grade mineral block estimated to contain about 450 million tonnes ore.

The partners decided in May 1980 to sink an exploration shaft to further evaluate the geology and overall characteristics of the deposit. The Whenan shaft (named after the driller of the discovery hole) was sunk to a depth of 500 meters and was in full operation by late 1982. Horizontal drifting, stope mining and long-hole drilling, primarily to complete delineation and supply metallurgical samples of the high-grade ore block, proved extremely successful. Over 1.2 million tonnes of ore and waste have been hoisted to the surface to date. Over 13 km of drifts, generally measuring 6 meters wide by 4.5 meters high, have been driven on three working levels to accommodate large equipment. Test mining is underway at numerous stopes, and over 1,100 long holes have been drilled, mostly in closely-spaced fan patterns above and below each drill station. The shaft and all underground work, including the location of workshops, supply and service areas, were designed to complement commercial development activity, although each facility may have to be upgraded to handle the increased capacities which are anticipated. Figure 4 illustrates a vertical cross-section of the Whenan shaft, showing the position of the three mining levels. Figure 5 indicates the large dimensions of development drifts.

Olympic Dam ore reserves, based on evaluation results of surface drilling, underground mining and long-hole drilling, were estimated in July 1982 and November 1983, as follows:

July 1982 estimate of total mineralized material based on surface drilling = 2,000 million tonnes containing:

Metal	Grade	Metal Content
Copper	1.6 percent	3.2 million tonnes
Uranium	0.06 percent	1.2 million tonnes
Gold	0.6 g/t	1.2 million kg
Silver	3.5 g/t	7.0 million kg

November 1983 estimate of probable ore reserves, high-grade block = 450 million tonnes (included in total resource estimate) containing:

Metal	Grade	Metal Content
Copper	2.5 percent	11 million tonnes
Uranium	0.08 percent	360,000 tonnes
Gold	0.6 g/t	270,000 kg
Silver	6.0 g/t	2.7 million kg

A 5-tonne per hour metallurgical pilot plant was built on site for testing ore to determine the optimum processing method and design parameters for commercial operations. The plant operated from March 1984 through November 1984, treating over 17,000 tonnes of ore taken from different locations throughout the mine. The pilot plant was equipped with conventional crushing, grinding and flotation circuits, producing over 1,400 tonnes of copper concentrates. Uranium was recovered via pressure leach and solvent extraction circuits, and precipitated as ammonium diuranate.

Roxby Management Services Pty. Ltd. (RMS), a wholly-owned subsidiary of WMC, is the project manager. RMS retained Fluor Australia Pty. Ltd. in July 1984 to study the technical aspects of the project for a full-scale commercial operation. The study was completed in March 1985, and covered resource evaluation, mining and processing procedures, support infrastructure facilities, construction and development costs, and efficiency requirements. RMS followed the technical study with its own feasibility study designed to determine the commercial viability of the project. That study focused on total financial

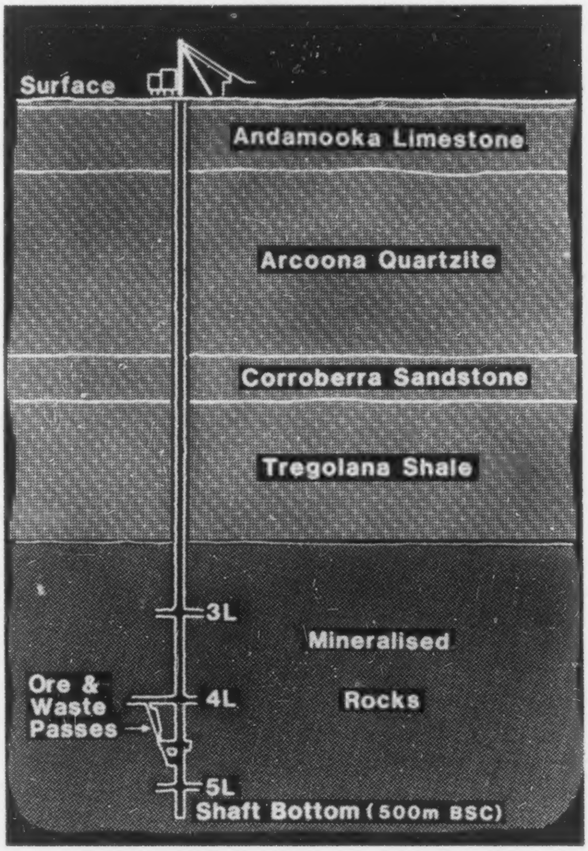

Figure 4. Vertical cross-section of the Whenan shaft.

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requirements based on sales revenue, cash flow, capital funding and debt servicing. The venture partners concluded from both studies that, within specific guidelines, the project was commercially viable; the deposit could be developed and minerals produced at competitive market levels, based on the combined values of both copper and uranium. Gold values provided added incentive. The partners announced in December 1985 that commercial development of the Olympic Dam deposit would proceed. Subsequently, development plans were finalized and approved by the partners, and construction began on March 6, 1986.

The Mine Development Program

The established production schedules for the Olympic Dam project require the simultaneous preparation of mining and processing capabilities, at extremely large capital expense. The development/construction program is scheduled in stages to accommodate increasing production levels over time. However, the schedule for expansion remains sensitive to economic changes. The markets for copper and uranium will be the key determinants to growth potential at Olympic Dam. The international commercial environment for both uranium and copper, as well as the uncertainties of political involvement with regard to marketing uranium, must be considered in advance of each expansion phase. Nevertheless, the partners have considered these uncertainties and have elected to proceed with project development.

The development plan, formulated following the successful pilot test program, was enacted in March 1986. In essence, the plan requires the simultaneous development of the ore deposit to accommodate large-volume mining, as well as the construction of ore processing facilities that will achieve the maximum recovery of contained metals. To facilitate efficiency, all project design and construction work is under the direction of RMS. Outside contract engineering and construction groups are carrying out the actual construction of the ore processing facilities. Mine preparation is the responsibility of the RMS operations staff.

Underground development work is progressing rapidly, as over 13 km of drifting has been completed on the three working levels

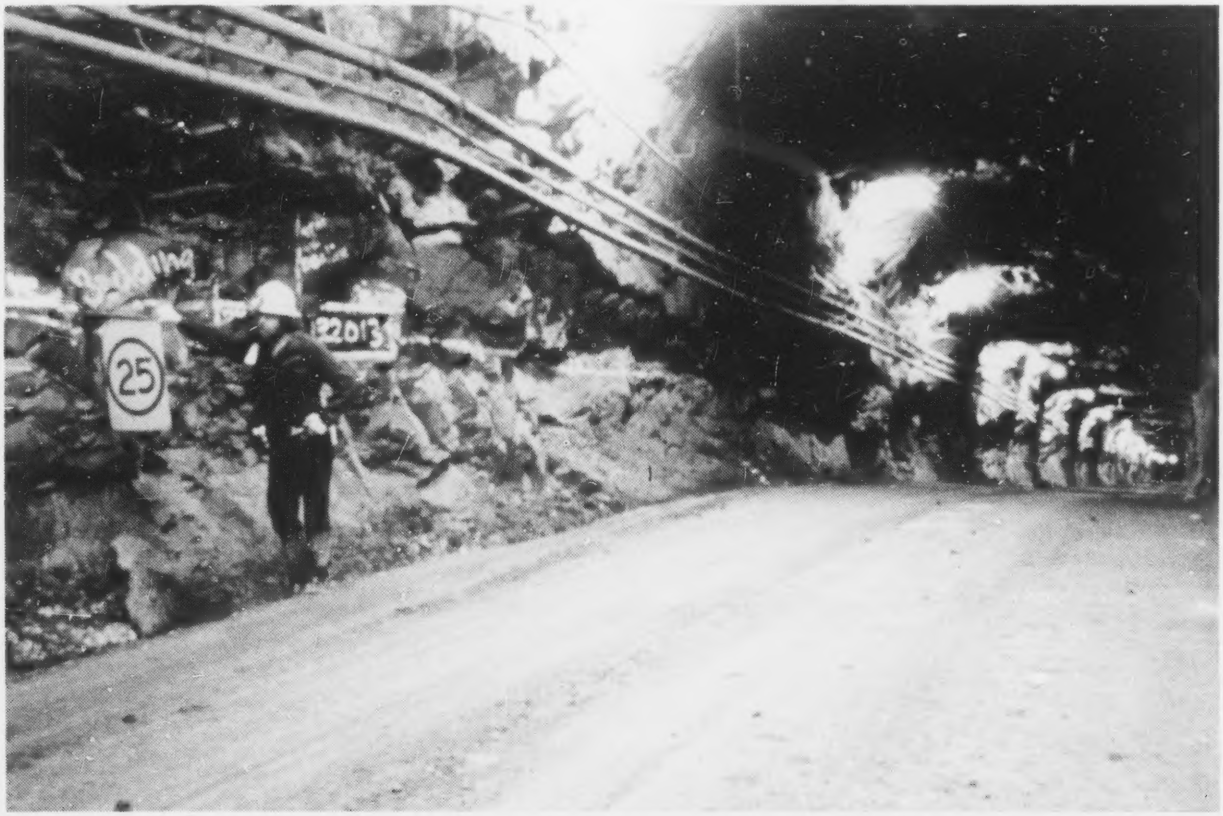

Figure 5. Underground drift development at Olympic Dam. Large drifts will accommodate high-volume mining equipment.

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off of the Whenan shaft (Figure 5). The initial mine plan involves exploitation of the probable ore reserves, containing over 450 million tonnes of high-grade material. However, the plan is only the first step in the long-term objective of mining and processing the 2,000 million tonnes of ore during the next 150 to 200 years. To accomplish such a long-range task in an efficient manner, the ore deposit was divided into eight parts, Mine Areas A through G, plus the Greenfield Formation (Figure 6). Each Mine Area boundary was arbitrarily established on the basis of geological and structural interpretation and the nature of mineral occurrence. Areas A through D were more thoroughly evaluated than the remaining areas, primarily because of higher mineral values encountered there. The "L"-shaped area between areas B and G is the Greenfield mine area, herein unofficially designated GR. It consists of the down-faulted portion of the graben occupied by the Greenfield Formation. The area contains low-grade mineralization not readily accessible to mining.

Initial project development, scheduled for completion by 1988, will facilitate production at an annual rate of 30,000 tonnes of refined copper, 5.2 million pounds of uranium oxide, and 90,000 ounces of gold per year. To accomplish and maintain this goal through the first three operating years, mine development will be accelerated to a production level of one million tonnes per annum (tpa) of copper/uranium ore, primarily from Mine Area D, with lesser tonnage mined from Areas A, C, and F as the development of each area is advanced. In addition, about 0.5 million tpa gold ore will be produced from Mine Area B. Another 0.5 million tpa of waste could be produced from new development work.

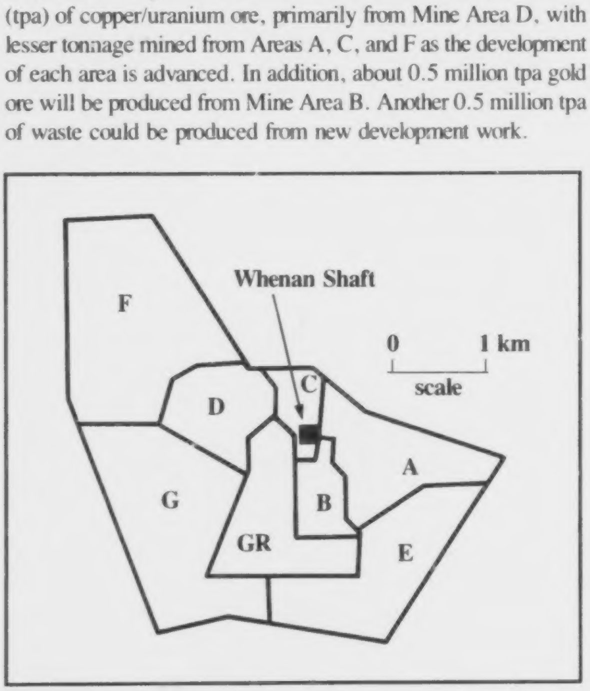

Figure 6. Plan map showing divisions of the project into specific Mine Areas.

Hoisting capacity of the Whenan shaft will limit production during the first three years. To overcome this problem, selective mining in Area D will yield ore averaging 3 percent copper and 0.13 percent U_3O_8; gold values as high as 5.0 g/t will be mined from gold-rich ore lenses scattered throughout parts of Mine Area B. The production ratio between copper-uranium ore and gold ore will be adjusted if necessary to meet production schedules and to take advantage of changes in ore grade and market opportunities.

Ore grades are expected to gradually decrease to the average level of the probable ore reserves during the early years of project development — 2.5 percent copper, 0.08 percent U_3O_8, and 0.6 g/t gold. Production of copper-uranium ore will be increased to 2 million tpa by that time to maintain the level of U_3O_8 production at 2,000 tpa and allow refined copper production to increase to about 55,000 tpa, as scheduled from the fourth year to the fifteenth year of the project. Ore production from Mine Areas A, C, and F will be increased to help meet tonnage requirements. A second shaft will be required for additional hoisting capacity by 1991. It will be designated Shaft #2, and will be located about 1,000 meters west of the Whenan shaft. The depth of the #2 shaft has not been determined, but early assessment indicates a depth of approximately 800 meters will be necessary to allow mining of the lower ore zones, presently unreachable from the Whenan shaft. Shaft #2 eventually will become the main production center, potentially having a hoisting capacity that exceeds 4 million tonnes annually.

Actual mining procedures will require the application of highly mechanized techniques. Large-volume mining is required to achieve production targets and to minimize operating costs. Usually, the thickness of ore will determine mining procedures. A large portion of the deposit consists of massive mineral zones exceeding 30 meters in thickness. Those zones will be mined by sublevel open-stope methods, whereby blasted ore will drop to a sublevel drawpoint for out-loading. A large portion of daily production will be mined by this method. Thinner ore zones will be mined by post-pillar stoping, which requires the development of a pillar sequence, followed by a systematic reduction of pillar size as retreat mining takes place. Broken ore will be loaded directly into trucks for removal to the hoisting center. All mined-out areas will be subject to backfilling in order to maintain ground stability. Waste rock may be used, but process tailings will be the main source of backfill material, and will be piped as a slurry from the surface directly to the fill area.

Metallurgical Process

Early laboratory and pilot plant testing revealed the complex nature of the Olympic Dam ore. The mineralization occurs in highly hematitic gangue material in host breccias. All contained minerals (copper sulfides, uranium oxides and silicates, gold,

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silver, and rare earths) occur as finely disseminated grains throughout the breccia matrix. The details for mineral recovery from the host environment were developed during pilot testing; the final flowsheet development and plant design was assigned to specialized consulting groups.

Construction of the various recovery circuits is well underway. The facilities will be built in module form to sustain planned expansion phases for the project. The first module constructed will be of sufficient capacity to process initial ore production of 1.5 million tpa. A second module will be required by the fourth operating year in order to process the 2.0 million tpa now planned. The need for additional modules will greatly depend on the grade of ore mined and market demand for Olympic Dam production. Figure 7 is a diagrammatic flow sheet of the metal recovery process.

The recovery process begins with ore preparation. Primary crushing occurs underground; the crushed ore will be hoisted to the surface and sent directly to the concentrator plant, where secondary (fine) grinding takes place in ball mills. From the secondary grinder, the ore is sent to the flotation circuit. The production of copper concentrates will take place utilizing conventional flotation, consisting of rougher cells and two-stage cleaner cells. Approximately 92 percent of the copper, 15 percent of the uranium, and 75 percent of the gold and silver in the ore feed will accumulate in the concentrate. Copper and uranium remaining in the flotation tails will be recovered in the hydrometallurgical plant, and the remaining precious metals will be recovered prior to tailings disposal. Concentrate from the flotation circuit then passes through an acid leach and reflotation circuit to produce a copper, gold and silver concentrate. Leached uranium will pass in solution to the uranium solvent extraction circuit. Gold and silver are separated from copper in a special gravity circuit and sent to the gold plant, and the copper concentrate, along with trace amounts of gold and silver, pass on to the smelter.

Extraction and recovery of uranium from the acid-leach solution and flotation tailings will take place in the hydrometallurgical plant. Pregnant solution from the leach and reflotation circuit will be comingled with pregnant solution generated from a separate flotation tailings leach circuit. The uranium-rich stream will pass through the solvent extraction circuit for concentration. Uranium will then be stripped from the aqueous solution with ammonium sulfate and precipitated as ammonium diuranate (ADU). The precipitate will be calcined at about 600 degrees C. in order to oxidize the ADU to uranium oxide (U_3O_8) prior to packaging. Soluble copper contained in the pregnant solution is removed as the solution passes through a separate solvent extraction circuit; it is recovered in the refinery as cathode copper by electrowinning, the process of electroplating.

High-grade copper concentrate containing abundant sulfides from the flotation circuit will be sent to the smelter for the production of blister copper. The final copper product produced at Olympic Dam will be cathode copper, produced in the refinery. Initially, the refinery module will have the capacity to produce 30,000 tonnes of cathode copper per year; a second module will be required to reach 55,000 tpa of copper metal. Gold and silver recovery is initiated in the flotation circuit, where about 75 percent of contained values are recovered. Gold and silver bullion is produced from the final concentrate.

Tailings from the metallurgical process will be disposed of in two separate environments. The main tailing stream will exit the processing system at the gold desliming circuit. The material will flow into four prepared retention areas. The discharge will be rotated continuously between four areas to allow settling and consolidation into a layered sequence of a high-strength, competent material which will withstand water and wind erosion. Secondly, the dewatered sands from the gold carbon-in-leach circuit will be delivered underground for backfill in mined-out areas. Each fill area will be barricaded to facilitate the build-up of a solid, compacted block, which offers limited support for a particular area and allows for minimized and controlled caving conditions.

Mineralization

The nature of mineral occurrence in the Olympic Dam deposit has been further revealed in the underground workings and in the cores from over 110,000 meters of long-hole drilling. The mineral suite, consisting of copper, uranium, gold, silver and rare earths, is contained in hematite-rich breccias of the Olympic Dam Formation, age dated Middle Proterozoic. The formation consists of sedimentary breccias, occupying the Olympic Dam graben, the main tectonic feature associated with the ore deposit. Mineralization shows concentration in zones of intense hematite, sericite, silica and chlorite alteration in the four upper members of the Olympic Dam Formation; the formation sequence above and below generally shows evidence of similar alteration patterns, but each is essentially barren of mineralization.

The upper portion of mineralization was previously thought to be contained in host rock designated as the Lower Silicified Member of the Greenfield Formation, directly overlying the Olympic Dam Formation. Underground observation revealed that no such stratigraphic member exists. In actuality, the sericite zone in the Upper Granite Breccia Member of the Olympic Dam Formation gives way to intense silification that extends upward into the Greenfield Formation.[1] Important mineralization is now

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[1] *The Olympic Dam Copper-Uranium-Gold Deposit: II — New Developments*, OD30-11, 1986, D.E. Roberts and N.L. Godden, page 14.

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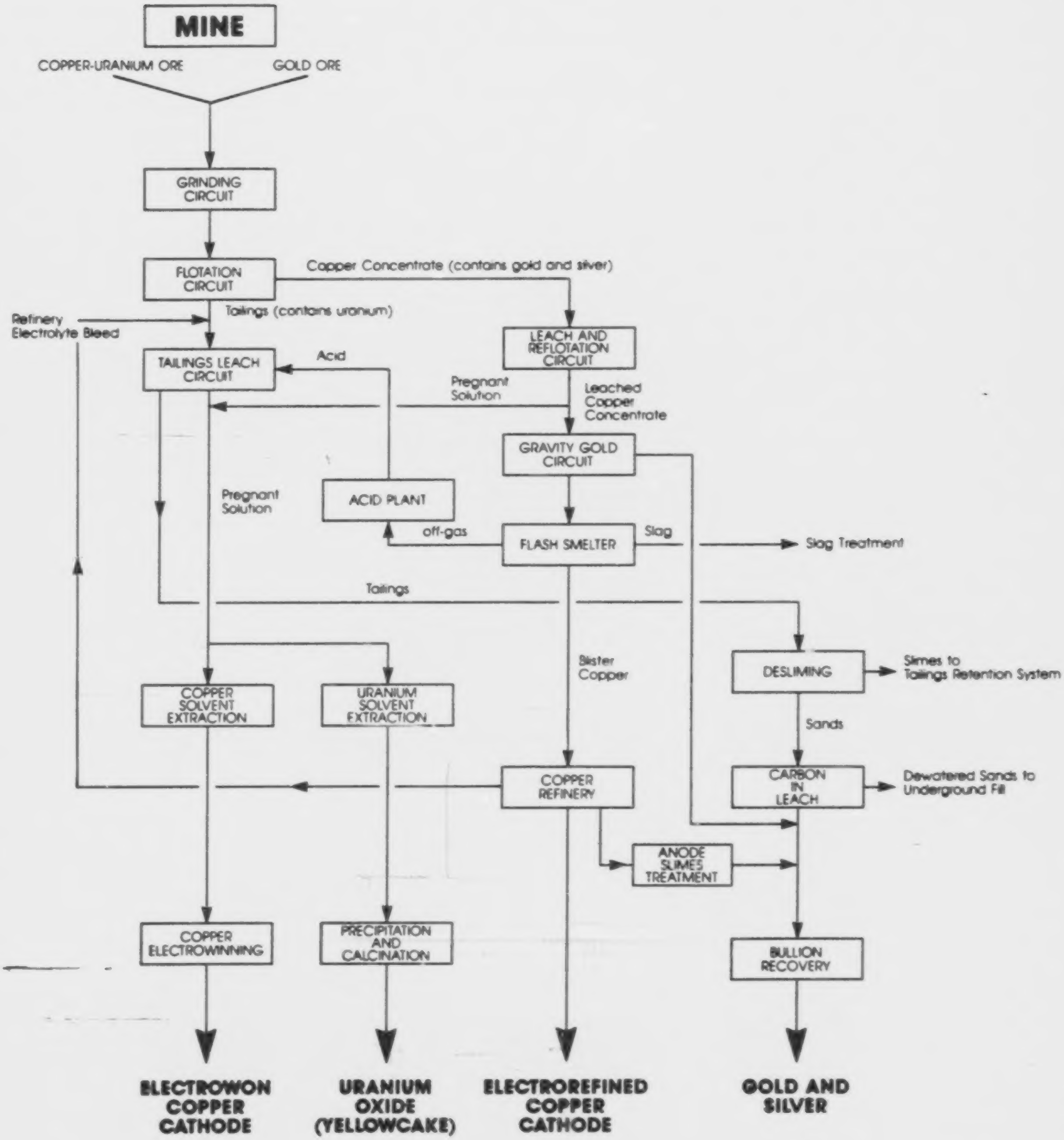
MINE
COPPER-URANIUM ORE
GOLD ORE
GRINDING CIRCUIT
FLOTATION CIRCUIT
Copper Concentrate (contains gold and silver)
Tailings (contains uranium)
Refinery Electrolyte Bleed
LEACH AND REFLOTATION CIRCUIT
TAILINGS LEACH CIRCUIT
Acid
Pregnant Solution
Leached Copper Concentrate
GRAVITY GOLD CIRCUIT
Pregnant Solution
ACID PLANT
off-gas
FLASH SMELTER
Slag
Slag Treatment
Tailings
Blister Copper
DESLIMING
Slimes to Tailings Retention System
Sands
COPPER SOLVENT EXTRACTION
URANIUM SOLVENT EXTRACTION
COPPER REFINERY
CARBON IN LEACH
Dewatered Sands to Underground Fill
ANODE SLIMES TREATMENT
COPPER ELECTROWINNING
PRECIPITATION AND CALCINATION
BULLION RECOVERY
ELECTROWON COPPER CATHODE
URANIUM OXIDE (YELLOWCAKE)
ELECTROREFINED COPPER CATHODE
GOLD AND SILVER

Figure 7. Flow sheet of mineral recovery process at Olympic Dam.

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considered to be confined to the four upper members of the Olympic Dam Formation, which are listed in descending order and described as:

Upper Granite Breccia Member (100 m thick)	Hematite-rich granite breccia, chalcocite and bornite minerals.
Brooks Member (300 m thick)	Mixed rock breccias, hematite-rich, chalcopyrite, bornite and chalcocite minerals.
Whenan Member (350 m thick)	Mixed rock breccias, bedded black and red hematite matrix, bornite and chalcopyrite minerals.
Black Hematite Member (150 m thick)	Black hematite breccias, altered and vuggy, chalcopyrite mineral.

It has become clear that the mineral zones vary considerably. Steeply dipping to nearly flat-lying zones are often discontinuous, ranging in thickness from less than one meter to over 50 meters. However, continuous zones may extend for hundreds of meters along both strike and dip dimensions. The flat-lying zones are often over 200 meters thick and cover hundreds of thousands of square meters in areal extent. Underground drilling has established many important characteristics of various mineral zones, especially the steeply dipping zones that are difficult to interpret from surface drilling results.

Two types of copper sulfide mineralization exist in the deposit. The types, designated strata-bound and transgressive, are based on the occurrence and distribution of sulfide minerals present, and other contained minerals are closely associated with either or both types. Occurrence by type is usually isolated and readily identifiable, but overlapping, lateral or vertical intrusions may occur, primarily in the vicinity of intrusive contacts and structural and alteration changes.

The most important and much more abundant mineralization occurs as strata-bound accumulations of bornite (Cu_5FeS_4) and chalcopyrite ($CuFeS_2$), with lesser amounts of chalcocite (Cu_2S). The minerals are fine-grained and evenly distributed throughout the matrix of the host breccia zones, making up 5 to 15 percent of the rock. The vertical thickness may exceed 350 meters. Intergrowths of chalcopyrite and pyrite with hematite make up the largest particles, often up to 5 cm in size. The mineralization is considered syngenetic, being deposited along with the material making up breccias as they occur in the two lower-mineralized members. The source of sulfide minerals may have resulted from geothermal activity associated with regional volcanism and igneous intrusions. Transgressive type mineralization is second in importance of occurrence. It consists of chalcocite and bornite sulfides which generally overlie the strata-bound mineralization. The source of mineralization is thought to be mineral-rich solutions migrating through the upper formations during late stages of the mineralizing event as it relates to intrusive activity and associated structural changes; thus, the sulfides are considered to be epigenetic. The age of sulfide mineralization has been estimated at about 1,580 million years.

Uranium minerals are disseminated throughout both types of sulfide mineralization as extremely fine-grained particles up to 0.1 mm in size. In strata-bound sulfide zones, uranium seems to be evenly distributed, whereas in transgressive zones it may form in uranium-rich veins and as segregations. The main uranium mineral present is uraninite (UO_2). It is almost ubiquitous throughout the sulfide zones. Coffinite [$U(SiO_4)$] occurs in close association, primarily in highly altered zones, as coating on fractures and veins, and as discrete grains of breccia matrix. Brannerite occurs spatially as vein-filling material limited to the Brooks Member. It is often associated with sericite and hematite alteration. Each brannerite grain is usually surrounded by a halo of rutile (TiO_2), forming an unusual mineral combination.

Free gold is lightly scattered throughout much of both sulfide zones with a slightly higher concentration in the transgressive ore zone. It also occurs well-disseminated in hematite-rich matrix, in microveinlets adjacent to sulfide zones, and in barite veins and silicified zones in granite breccias. The gold-rich zone (Mine Area B) occurs in a structurally disturbed area (highly fractured and sheared) within the Upper Granite Breccia Member of the Olympic Dam Formation, where it is in close contact with the eastern edge of the graben-confined Greenfield Formation. The gold mineralization overlies strata-bound copper-uranium and is separate from transgressive copper-uranium zones while occurring within the same stratigraphic sequence. Silver is associated with gold, but shows higher values in bornite-rich sulfide zones. It occurs as native silver and silver tellurides.

Two rare earth minerals, bastnaesite and florencite, occur in association with sericite, hematite, and fluorite in the breccia matrix. Combined, the minerals average 0.50 percent rare earths. The recovery of either mineral is currently not under consideration in overall project planning due to the extremely low grade.

Geology of the Region

The Olympic Dam project area is located in the northwestern part of the Stuart Shelf region, which is part of the Australian Shield complex. The oldest rocks in the region consist of Archean

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gneiss, schist and intrusives of the Gawler domain (Figure 3). The Stuart Shelf sedimentary sequence, which is Upper Proterozoic in age (Adelaidean), is about 350 meters thick. It overlies the basement rocks of the Gawler domain, the upper part of which consists of a Middle Proterozoic sedimentary sequence that includes the Olympic Dam Formation — host of the Olympic Dam ore deposit.

The eastern half of the Stuart Shelf is separated from the western half by the Torrens hinge zone, a major north-south trending fault system. Geologic structure east of the hinge zone is characterized by complex folding and faulting of basement rocks; west of the hinge zone the structural features consist of the Adelaide geosyncline and associated parallel folding. The major unconformity separating basement rocks from Adelaidean sediments masks basement structural features; thus, the presence of the Olympic Dam graben was revealed by drilling. The sedimentary breccias filling the graben indicate structural displacement of more than 600 meters.

The graben-filling breccias were deposited under contrasting conditions of rapid weathering and erosion, which accompanied extreme tectonic activity related to development of the graben. It was formed during the Kimban orogeny, which has been age dated at about 1,800 to 1,580 million years. The Stuart Shelf region has been geologically stable since the Kimban orogeny, so deep-seated structural features, including the graben and the mineral deposit, were unaffected by the long period of erosion preceding deposition of Stuart Shelf sediments.

Exploration drilling on three geophysical anomalies along the northwest part of the Stuart Shelf have resulted in the discovery of copper-uranium mineralization of Olympic Dam, Acropolis and Wirrda Well. A number of promising geophysical anomalies have yet to be tested. In addition, there is some correlation between the Mt. Painter copper-uranium deposit, located along the northeastern edge of the Stuart Shelf about 230 km east of Olympic Dam, and all three aforementioned deposits in geology and mineral occurrence. Based on this encouraging geologic evidence, the Stuart Shelf region has a large potential for additional mineral districts.

* * *

Nuexco wishes to acknowledge the cooperation of Roxby Mining Corporation Pty. Ltd. and BP Australia Ltd. in the preparation of this article.

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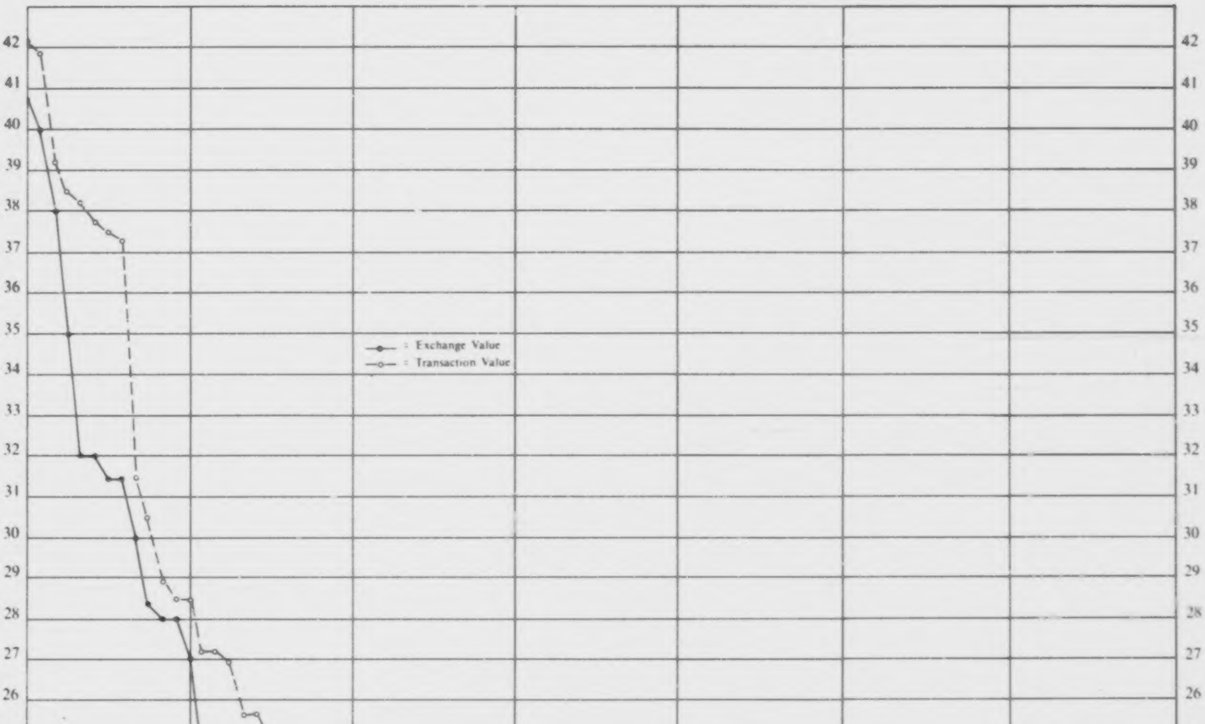
HISTORICAL MARKET DATA

EXCHANGE AND TRANSACTION VALUES
SINCE JANUARY 1980

Determined as of the last day of the month indicated



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HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	17.00	17.00	17.00	**17.00**			

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.15	17.20	17.50	17.45	**17.35**			

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U in UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.80	1.90	1.80	1.80	1.80	1.90	**1.90**			

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AUSTRALIA

	Price Index of Materials Used in Manufacturing Industry — All Groups[1] (1984 = 100)	Award Rates of Pay Indexes Australia — Adult Males In Mining Wage Earners, Weekly Rates[2] (1976 = 100)
1975 Avg.	150.4	132.6
1976 Avg.	168.4	160.9
1977 Avg.	192.0	179.0
1978 Avg.[3] [4]	198.5	190.0
1979 Avg.	248.8	127.9
1980 Avg.	321.8	140.8
1981 Avg.	355.3	154.1
1982 Avg.[5]	368.6	174.9
1983 Avg.	401.6	181.8
FY84 Avg.[6]	95.3	—
FY85 Avg.[6]	100.0	—
Jan 1985	97.0	197.8
Feb 1985	98.6	197.8
Mar 1985	102.1	197.8
Apr 1985	104.4	202.8
May 1985	107.6	202.4
Jun 1985	108.7	202.4
Jul 1985	111.1	202.4
Aug 1985	110.5	202.4
Sep 1985	108.9	202.5R
Oct 1985	108.7	202.4
Nov 1985	109.6	209.9R
Dec 1985	110.2	210.0R
Jan 1986	109.8	210.0R
Feb 1986	108.9	210.0R
Mar 1986	99.7	210.0R
Apr 1986	94.5	210.0R
May 1986	93.8	210.0R
Jun 1986	95.9P	210.0R
Jul 1986	—	214.7

P = Preliminary R = Revised since last month

[1] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0). The basis of this index was revised to 1984 = 100. The previous index was 1969 = 100.

[2] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

[3] Monthly data for 1970-78 appear on pages 4.7 and 4.8 of Report 138.

[4] Annual averages prior to 1979 reflect index base no longer in use.

[5] Monthly data for 1979-82 appear on page 35 of Report 184.

[6] Annual averages are for financial year ending June 30.

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CANADA

	Industry Selling Price Index: All Commodities[1] (1981 = 100)	Wage-earner Data: Average Hourly Earnings (C$)[2]					
		Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells[3] (SIC 051-099)	Primary Non-ferrous Metal Industries[4] (SIC 296)	(SIC 298)	Chemicals and Chemical Products[5] (SIC 372-379)
1979 Avg.[6]	217.9	—	9.60	9.66	—	—	7.67
1980 Avg.	247.2	—	10.58	10.80	—	—	8.50
1981 Avg.	288.7	—	12.02	12.23	—	—	9.53
1982 Avg.[7]	288.8	—	13.74	13.92	—	—	10.63
1983 Avg.	298.8	—	—	14.30	—	—	11.17
1984 Avg.	310.9	17.88	—	15.07	12.28	10.49	11.76
Jan 1985	117.5	18.05	16.13	15.60	12.32	10.80	12.04
Feb 1985	117.7	18.78	16.41	15.68	12.52	11.05	12.06
Mar 1985	118.4	18.24	16.21	15.57	12.44	10.97	12.02
Apr 1985	118.3	18.63	16.44	15.80	12.81	11.23	12.04
May 1985	118.6	19.41	16.51	15.63	12.76	11.25	12.15
Jun 1985	118.6	18.49	16.20	15.49	12.89	11.14	12.14
Jul 1985	118.6	18.14	16.27	15.41	12.96	11.17	12.13
Aug 1985	118.4	17.07	16.03	15.30	12.97	11.31	12.19
Sep 1985	118.6	18.53	16.55	15.72	12.95	11.39	12.26
Oct 1985	119.0	18.74	16.51	15.70	13.14	11.53	12.33
Nov 1985	119.3	19.05	16.66	15.88	12.76	11.32	12.49
Dec 1985	120.0	19.07	16.57	16.01	12.51	11.09	12.59
Jan 1986	121.0	18.15	16.22	15.86	13.11	11.48	12.52
Feb 1986	120.8R	19.52	16.57	15.99	13.20	11.59	12.45
Mar 1986	120.1R	19.04	16.65	15.93	13.11	11.59	12.54
Apr 1986	119.4R	19.38	16.68	15.95	13.07	11.64	12.54
May 1986	118.6R	19.54	16.68	15.78	13.16	11.72	12.51
Jun 1986	118.8R	19.80	16.63	15.60	13.04	11.77	12.42
Jul 1986	118.9P	—	—	—	—	—	—

P = Preliminary R = Revised since last month

[1] Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Index prior to 1985, 1971 = 100.

[2] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours" (Catalogue 72-002).

[3] Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

[4] Beginning with the April 1983 figure, Primary Metal Industries, non-ferrous is split into SIC 296 and SIC 298.

[5] Chemical and Chemical Products prior to April 1983 was SIC 370-379. The new series is from a new survey which includes all companies and is based on a 1970 classification. The old survey only included companies of 20 employees or more.

[6] Monthly ISPI for 1977 and 1978 appear on page 4.10 of Report 138, and monthly wage-earner data for 1973-78 appear on page 4.11 of Report 138.

[7] Monthly data for 1979-1982 appear on page 37 of Report 184. On that page, the wage earner index entitled "Metal Mining, Including Milling (SIC 050-099)" should read "Total Mining (SIC 051-099)."

[8] Beginning with the March 1983 figure, Wage Earner Data are based on a census of all companies employing 200 or more wage earners, *plus* a random survey of companies employing fewer than 200 wage earners. Prior to March 1983 only companies employing 200 or more wage earners are included in the Wage Earner Data.

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GOVERNMENT STATISTICS

REPUBLIC OF SOUTH AFRICA

		Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1]	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100)[2]	Consumer Price Index[3] (1980 = 100)[4]	Producer Price Index All Groups[5] (1980 = 100)	Total Employment in Mining and Quarrying (Code 35)[6]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[6]
1975	Avg.	16.71	—	157.2	100.0	639,473	1,003,617
1976	Avg.	19.30	—	174.7	115.1	671,240	1,212,983
1977	Avg.	23.87	—	194.4	130.0	712,006	1,420,670
1978	Avg.	27.14	—	137.2	142.7	664,571	1,537,169
1979	Avg.[7]	30.18	—	155.3	164.5	692,209	1,830,632
1980	Avg.[8]	35.53	—	176.7	192.1	714,379	2,279,615
1981	Avg.	41.89	—	206.5	218.3	728,506	2,820,505
1982	Avg.[9]	47.25	104.2	233.5	248.7	707,552	3,246,071
1983	Avg.	51.87	115.0	262.2	274.8	696,579	3,644,772
1984	Avg.	58.95	130.3	292.8	297.9	712,080	4,196,764
Jan	1985	—	—	177.1	166.6	711,366	376,777
Feb	1985	—	—	182.8	171.3	727,932	361,823
Mar	1985	64.48	142.4	183.6	173.0	708,809	371,380
Apr	1985	—	—	187.4	174.0	724,187	369,005
May	1985	—	—	189.5	177.7	708,085	373,478
Jun	1985	67.42	148.9	191.9	179.2	724,587	395,543
Jul	1985	—	—	193.6	180.7	738,228	419,106
Aug	1985	—	—	195.6	183.2	734,121	416,777
Sep	1985	70.47	155.3	197.8	184.8	732,836	419,883
Oct	1985	—	—	200.8	188.1	720,071	401,448
Nov	1985	—	—	203.4	196.0	750,049	432,996
Dec	1985	72.43	160.1	207.4	199.4	741,372	425,261
Jan	1986	—	—	213.8	203.6	744,070	449,513
Feb	1986	—	—	215.8	206.9	754,458	438,562
Mar	1986	75.76	167.8	218.3	206.9	759,897	445,387
Apr	1986	—	—	222.2	208.9	756,388	437,563
May	1986	—	—	222.6	212.5	754,788	425,544
Jun	1986	77.65	172.0	224.4	213.3	755,354	461,887
Jul	1986	—	—	228.8	216.3	—	—
Aug	1986	—	—	232.2	—	—	—

[1] Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly.

[2] Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

[3] Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."

[4] The basis for calculation prior to January 1985, 1975 = 100. For annual averages prior to 1978, April 1970 = 100.

[5] Previously known as the Wholesale Price Index, now the Producer Price Index. The computation remains the same. The basis for calculation prior to January 1985, 1975 = 100.

[6] Bulletin of Statistics, Department of Statistics, Pretoria.

[7] Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 4.9 of Report 140.

[8] Monthly data for Codes 35 and 40, 1977-1980, appear on page 28 of Report 157.

[9] Monthly data for 1979-82 appear on page 39 of Report 184.

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UNITED STATES

	Producer Price Index[1]		Consumer Price Index[2]	GNP Implicit Price Deflator[3,4]	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[5]			
	Industrial Commodities (1967 = 100)	All Commodities (1967 = 100)	(1967 = 100)	(1982 = 100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980 Avg.[6]	274.8	268.8	246.8	178.64	10.26	10.63	8.30	6.94
1981 Avg.	304.1	293.4	272.4	195.51	11.55	11.98	9.12	7.62
1982 Avg.[7]	312.3	299.3	289.1	207.15	12.33	12.94	9.96	8.21
1983 Avg.	315.8	303.1	298.4	215.63	12.57	13.43	10.59	8.65
1984 Avg.	322.6	310.3	311.1	108.1	13.05	13.43	11.03	9.04
Jan 1985	322.9	309.5	316.1	—	13.29	13.70	11.39	9.33
Feb 1985	322.5	309.2	317.4	—	13.30	13.73	11.39	9.33
Mar 1985	322.6	308.7	318.8	110.4	13.29	13.95	11.37	9.39
Apr 1985	323.8	309.3	320.1	—	13.43	13.63	11.47	9.40
May 1985	325.3	309.8	321.3	—	13.24	13.60	11.44	9.39
Jun 1985	324.8	309.2	322.3	111.3	13.23	13.68	11.51	9.46
Jul 1985	324.4	309.0	322.8	—	13.45	13.83	11.59	9.47
Aug 1985	323.7	307.3	323.5	—	13.55	13.71	11.60	9.50
Sep 1985	322.3	305.5	324.5	112.1	13.44	13.68	11.65	9.54
Oct 1985	324.2	307.9	325.5	—	13.49	13.66	11.70	9.55
Nov 1985	324.7	309.5	326.6	—	13.49	13.97	11.80	9.61
Dec 1985	325.1	310.2	327.4	113.0	13.43	13.81	11.85	9.68
Jan 1986	323.8	308.9	328.4	—	13.40	13.69	11.86	9.60
Feb 1986	318.9	304.4	327.5	—	13.44	13.82	11.81	9.60
Mar 1986	314.0	300.3	326.0	113.5	13.38	13.93	11.78	9.62
Apr 1986	311.6R	298.2R	325.3	—	13.54	13.87	11.82	9.62
May 1986	311.7	299.2	326.3	—	13.46	13.79	11.89	9.64
Jun 1986	311.6	298.9	327.9	114.2	13.52	13.49R	11.94R	9.61R
Jul 1986	308.5	297.7	328.0	—	13.47P	13.22P	12.05R	9.68R
Aug 1986	307.7	297.2	328.6	—	—	—	11.99P	9.66P

P = Preliminary R = Revised since last month

[1] US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

[2] US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items.

[3] US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

[4] The basis for calculation of this index was revised to 1982 = 100. 1984 and 1985 figures have been adjusted to that basis. The basis for calculation prior to 1984, 1972 = 100.

[5] US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for 1977-1978 are adjusted to the March 1979 benchmark. Data for January 1979 and beyond are adjusted to the March 1980 benchmark.

[6] Monthly data 1970-1978 for Producer Price Index-Industrial Commodities, Consumer Price Index, and Employment and Earnings SIC codes 10, 333, and 28, and quarterly data for GNP Implicit Price Deflator appear on pages 4.6-4.8 of Report 139.

Monthly data 1977-1978 for Employment and Earnings SIC Codes 10, 333, and 28 appear on page 33 of Report 147.

Monthly data 1970-1978 for Employment and Earnings SIC Code 36 appear on page 23 of Report 154.

Monthly data 1977-1980 for Producer Price Index-All Commodities, appear on page 21 of Nuexco Report 158.

[7] Monthly data 1979-1982 for all listed indices appear on page 41 of Report 184.

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REPRESENTATIVES AND CONSULTANTS

JAPAN

Kazy Yokota
Japan Tech Services
Ohkura Building (3F)
1-4-10 Shiba Daimon
Minato-ku, Tokyo, Japan
Telephone: (81-3) 431-6031, 6025
Telecopy: (81-3) 434-6674
Telex: 242-5060 (JATECH J)

SOUTH AFRICA

Chris I. Von Christierson
Southern Prospecting (Pty) Limited
P.O. Box 61409
Marshalltown 2107
Republic of South Africa
Street Address:
10th Floor
Eagle Star House
70 Fox Street
Johannesburg 2001
Telephone: (27-11) 838-1868
(27-11) 834-4211
Telecopy: (27-11) 834-3148
Telex: 4-89878 SA

TAIWAN

Edward Bee
Bee & Liang Company, Ltd.
14 FL Universal Business Center
NO. 663, Tun Hwa South Road
P.O. Box 1396
Taipei, Taiwan R.O.C.
Telephone: (886-2) 704-9630
TWX: 785-11570 (BEELIANG)

UNITED STATES

Harold C. Lindberg
83-A Hardee Lane
Whispering Pines, N.C. 28327
Telephone: (919) 949-3622

SPECIAL CONSULTANTS

George J. Stathakis
International Investment Banking

James C. C. Stewart
U.K. Nuclear Industry

W. Bryan Webster
International Business Development

J. Robert Wolcott
International Business Development

NUEXCO

EXECUTIVE SUMMARY
REPORT 218
(All data as of September 30, 1986)

Exchange Value
$17.00, unchanged

The **Exchange Value** is **$17.00** per pound U_3O_8, unchanged since last month.

UF_6 Value
$48.00, unchanged

The **UF_6 Value** is **$48.00** per kilogram U as UF_6, unchanged since last month.

Transactions

Four recent natural uranium sales are reported, involving approximately **500 thousand** pounds equivalent U_3O_8. All of the sales involved spot or near-term delivery, and three met the conditions for inclusion in the Transaction Value. Two of the transactions involved natural UF_6.

Supply-Demand Ratio
remained at 2.9:1

Active spot and near-term **uranium supply** amounts to **4.1 million** pounds U_3O_8 equivalent, down 180 thousand pounds since last month. Active spot and near-term **uranium demand** totals **1.4 million** pounds, down 35 thousand pounds. The spot and near-term **supply-demand ratio** remained unchanged at **2.9:1.**

Transaction Value
$17.35, down $0.10

The **Transaction Value** is **$17.35** per pound U_3O_8, down $0.10 since last month. The calculation includes 13 transactions involving a total of 2.4 million pounds U_3O_8 and equivalent UF_6, and covers a period of 3 months.

Loan Rate
unchanged at 4%

The **Loan Rate** is **4 percent** per annum, unchanged.

Conversion Value
$1.90, unchanged

The **Conversion Value** is **$1.90** per pound U as UF_6, unchanged since last month. Active secondary market supply for conversion services for delivery within three years totals 2.0 million pounds U as UF_6. Active demand totals 650 thousand pounds U as UF_6. No secondary market conversion transactions are reported.

SWU Value for
delivery within
one year: $78

The **SWU Value** at .3 tails and for delivery within one year is **$78** per SWU, unchanged since last month. Three secondary market SWU transactions are reported involving less than 50 thousand SWUs.

* * *

Basic Considerations

In the past few years, one of the techniques used to facilitate transactions involving enrichment services has been the tails assay swap. It allowed a utility having fixed commitments of DOE SWUs to alter the transaction tails assay and exchange some of its natural uranium inventory for enrichment services, thereby reducing the amount of cash needed to procure a given amount of nuclear fuel. In most cases, the increasing acceptance of requirements-type enrichment contracts has reduced or eliminated the incentive for the scheme.

South Africa

The Atomic Energy Corporation of South Africa Limited recently released a report containing updated assessments of the nation's uranium resources. The report includes the latest official evaluation of trends in uranium exploration, production and prices, as well as discussions of geology and national policy matters.

United States

The Senate bill calling for a ban on the import of South African uranium oxide and ore was vetoed by President Reagan at the end of September. However, in the first week of October, both the Senate and the House of Representatives voted to override the veto, clearing the way for the bill to become law. Attention will now be focused on the interpretation of the measure, especially concerning the import of South African uranium by non-US entities.

Raw Materials

Development of the Olympic Dam project in South Australia is continuing, and construction of the project's commercial production facilities began in March 1986. The initial production schedule calls for annual production of over five million pounds U_3O_8 before the end of this decade.

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NUEXCO REPORT 218 FIGURES OF THE MONTH (September 30, 1986)	This Month (Report 218)	Last Month (Report 217)	12 Months Ago (Report 206)
Exchange Value[1]	17.00	17.00	16.00
Transaction Value[1]	17.35	17.45	15.10
UF_6 Value[2]	48.00	48.00	44.50
Loan Rate[3]	4%	4%	5%
Conversion Value[4]	1.90	1.90	1.60
Near-Term Uranium Supply[5]	4.1	4.2	2.1
Near-Term Uranium Demand[6]	1.4	1.5	1.1
Near-Term Supply-Demand Ratio	2.9	2.9	1.9
Recent Uranium Sales:			
Number of Transactions[7]	4	5	4
Quantity of Material[8]	0.5	1.5	0.3
Nuexco SWU Value:[9]			
at 0.3 tails assay and delivery within one year	78	78	—
USDOE SWU Prices:			
USEC	119.00[10]	125.00[11]	125.00[11]
AFC	153.00[12]	153.00[12]	153.00[12]
Requirements	157.00[12]	157.00[12]	157.00[12]
Market Value of Enriched UF_6[13, 14]:			
2.5 w/o U_{235}	458	458	459
3.0 w/o U_{235}	586	586	589
3.5 w/o U_{235}	717	717	722
4.0 w/o U_{235}	849	849	857

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[1] US $ per pound U_3O_8 equivalent.

[2] US $ per kilogram U as UF_6.

[3] Per annum.

[4] US $ per pound U as UF_6.

[5] Active inquiries to sell, for delivery within 12 months after contract signing (millions of pounds U_3O_8).

[6] Active inquiries to purchase, for delivery within 12 months after contract signing (millions of pounds U_3O_8).

[7] Uranium sales only; does not include loans, conversion, or SWU transactions.

[8] Millions of pounds U_3O_8, equivalent.

[9] US $ per SWU.

[10] Effective 10/1/86.

[11] Effective 10/1/85.

[12] Effective 10/1/84.

[13] Calculated using the Nuexco Exchange Value, Conversion Value, and 0.30 percent tails assay. From 4/30/85 to 11/30/85, calculations used in the Nuexco SWU Value for DOE origin and delivery by the end of FY86. As of 12/31/85, calculations use the SWU Value for delivery within one year.

[14] US $ per KgU as UF_6, rounded to the nearest $.

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